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STRINGING TRANSMISSION LINES.

An article by Mr. Alfred Still, printed elsewhere in this issue, on methods of determining sag and span in erecting conductors for transmission lines gives a very convenient graphical short cut to the solution of some of the otherwise difficult problems. The situation with respect to line construction has changed very radically since the early days of power transmission. Then transmission lines were laid out on the same general plan that has been followed for years in the construction of telephone, telegraph and electric-light lines. The poles employed were those customarily in use for general purposes, the spacing was about fifty to the mile, and the simplest approximation to the proper relations between sag and tension was all-sufficient in those days. For high voltages, however, a reduction in the number of insulation points becomes a matter of great importance, and in many instances, particularly in traversing rough country where the poles are set on widely differing levels, the computation of the supporting structure is no easy matter. Short cuts, therefore, such as Mr. Still presents are exceedingly useful. They are all more or less close approximations to a rigorous solution of the very difficult equations involved, and are in all probability quite sufficient in precision for any practical purposes. Of the data necessary in line design, certain items, like the ultimate strength and elastic limit of the wire and its variation in length with temperature when unstressed, are as well known as the conductivity and other electrical characteristics of the proposed line. The expansion due to temperature when under severe stress and the properties of the conductor following a stress beyond its elastic limit are by no means so thoroughly determined. In fact, a good deal of investigation is still necessary before these quantities can have definite values assigned to them.

The result is that in planning a line one has to keep on the safe side with respect to his assumptions concerning these factors, and having done this he can go on through the ordinary computations with considerable confidence. Laying out a line subject only to the normal stresses that come from its own mechanical characteristics is an easy matter, rendered all the easier by graphical devices like that before us. The really serious questions in the design of a transmission line or engineering structure are those which have to do with the abnormal stresses which come upon it from wind, sleet, extraordinary temperature variations, and failure of lines or supports taken singly or in combination. The meteorological conditions along a proposed line are of fundamental importance, and a knowledge of them may make a considerable difference in the cost and security of the resulting structure. As a rule, the possible wind pressure is exaggerated, owing to the fact that the anemometers in general use overrun on the high

velocities by a large percentage, and the results obtained from them are almost universally published uncorrected. The velocities taken on any assumption regarding the condition to be met on a given line must therefore, as Mr. Still indicates, be reduced to the actual velocities by tables which are now fairly well known. A similar uncertainty exists regarding the probable effects of sleet. As a general meteorological proposition, very high wind pressures and heavy coatings of sleet do not co-exist. In certain regions there is greater likelihood of this combination being found than in general, and if it is possible to obtain the data, the matter should in one way or another be taken into account prior to the design of a line. As a whole, transmission lines are less likely to fail from sleet than most others, since the wires are generally exceptionally strong and accumulate no thicker sleet, at least, than do weaker wires. As a rule, the power-distribution circuits generally will go down before the transmission line.

In modern transmission circuits at high voltage where suspension insulators are freely used, and indeed where pin type insulators are employed, another danger enters, of which small account is usually taken. Lines are almost universally designed for the static stresses alone, but in long spans the dynamic stresses owing to persistent and violent swaying of the wires during wind must be reckoned with. Actual swaying of the lines so that they touch, or approach near enough to flash across, is a very rare although not unknown phenomenon, but the effects of gusts in imposing unusual stresses on the line structure have sometimes to be reckoned with, usually only at particular points on the line. Some instances of special anchoring to overcome such difficulties have been mentioned in these columns. And, finally, the questions of extraordinary stresses on the supporting structures due to breakage of one or more wires have to be considered with reference to the proportioning of sag and span. Most of the early lines were built upon the theory that the structure must stand rigidly even if the conductors of a given span should all give way. Such a requirement becomes unnecessary if the supporting structures are planned for a certain amount of flexibility either in the poles or towers or in the suspension. One of the great advantages of the suspension insulators lies in the fact that this flexibility can be and is given in the method of supporting the wires. It is no longer in the least necessary that every tower should be able, as a rigid support, to take the full stress due to the failure of the conductors. A broken conductor now merely redistributes the stresses between two anchorages. Even with pin-type insulators the tie-wires ought to be planned to allow slipping rather than to permit the conductor breaking the pin or wrenching off the insulator in a case of breakage. More than this, the poles or towers themselves can be given a certain flexibility well within their elastic limits, so that failure of a span will be of little moment, save as a temporary inconvenience. The steel A poles so freely used by the Italian engineers are an admirable instance of conferring flexibility on a line of very simple design. Sag and span calculations therefore, important as they are, are only a means to an end, and it is their relation to the mechanical design of the supports which is the thing of ultimate importance.

HYSTERESIS TORQUE.

In an article by Prof. D. Robertson in a recent issue of the London *Electrician*, as noted in the *Digest* last week, attention was called to certain features of the hysteresis in the secondary core of an induction motor. On account of the fact that this hysteresis is accompanied with a torque in a direction tending to accelerate the rotor to full synchronous speed the author makes the somewhat startling statement that the hysteresis in the secondary core is not a source of loss. It would appear to be equally logical to state that there is no loss in the secondary conductors because the current in them produces a torque in the primary magnetic field. The real fact to which the author directs attention has long been fully recognized, namely, that of the total power received by the secondary the amount dissipated by hysteresis varies directly with the slip. However, the accelerating torque attributable to hysteresis is constant from standstill to synchronous speed, and there is no change in the power taken from the primary for hysteresis throughout this speed range. Thus, to the extent that the speed approaches synchronism the synchronous torque produces useful power output, and the dissipation by loss in the secondary core disappears. It is especially worthy of note, however, that the hysteresis loss in the secondary iron is a real quantity, directly determinable by the well-known hysteresis loss formula involving the magnetic density and the frequency of reversal, which in this case bears to the primary current frequency the ratio of the slip to the synchronous speed. That this loss is small at speeds near synchronism is true, but to state that there is no secondary hysteresis loss is to ignore the well-established fact that the secondary core is subjected to the same laws of dissipation of energy by reversal of magnetic flux as is any other core in which the flux varies in value or direction.

THE TEMPERATURE-COEFFICIENT OF RESISTIVITY AND THE CONDUCTIVITY OF COMMERCIAL COPPER.

As noted in our *Digest* recently two important researches on the electrical properties of copper have been made and published in the *Bulletin* of the Bureau of Standards, one on the electric conductivity of commercial copper, by Messrs. Wolff and Dellinger, and the other on the temperature-coefficient of copper resistivity, by Mr. J. H. Dellinger. Copper and its resistivity are of great importance in electrical engineering. Moreover, although the physicist is more interested in the behavior and properties of pure copper, the electrical engineer is more interested in the behavior and properties of good, average commercial copper. A result of salient importance reached in these researches is that within the small limits of variation in electric conductivity of good commercial copper the temperature-coefficient and the conductivity are directly related to each other, so that copper of 98 per cent conductivity has 98 per cent of the temperature-coefficient of standard copper having 100 per cent conductivity. This standard is not identical with Matthiessen's standard, although not far from it. The standard for annealed copper is taken as 0.153022 international ohm for the resistance of a meter of uniform copper wire weighing 1 gram at 20 deg. C. This corresponds to 0.141068 ohm for the

meter and gram at zero C. In practice the conductivity of wires is always measured by mass, or with reference to the meter and gram, rather than by volume, or with reference to the centimeter cube, because the diameter cannot be measured with a precision approaching that of finding the mass. If, however, the density of copper be taken as 8.89 at 20 deg. C., corresponding to 8.90 at 0 deg. C., then the volume resistivity of standard copper at the bureau is 1.72128 microhm-cm at 20 deg. C.

Accepting a straight-line law of resistivity between 0 deg. C. and 100 deg. C., as now is universally adopted, copper behaves within this range as though it had zero resistivity at a certain low temperature which is above the absolute zero of gases and which has been reached experimentally. By actual measurement copper had a small but quite definite resistivity at that temperature, so that the same straight-line law does not continue to hold down to such very low temperatures. Nevertheless, if we keep within the working range of temperatures, 0 deg. C. to 100 deg. C., copper behaves as though it had an absolute temperature of zero-resistivity similar to the absolute temperature of zero volume in gases at — 273 deg. C. Just as the volume of a gas is proportional to its absolute temperature from this datum — 273 C., so the resistivity of standard copper is proportional to its "absolute resistivity temperature," which starts at — 234 deg. C. Hence in passing from 0 deg. C. to 50 deg. C. and 100 deg. C. the resistivity of standard copper rises in the ratio 234, 284 and 334 respectively. With copper of, say, 98 per cent conductivity the absolute zero would be increased to — 234/0.98, or — 239 deg. It is greatly to be desired that international agreement may shortly be reached over these very important constants of copper.

MAGNETIC PROPERTIES OF MANGANESE STEELS.

Steel, as a mechanical working material, is so wonderful a substance and presents so many and complex variations under slight changes of chemical or thermal treatment that a full understanding of its mechanism and internal working seems very remote. Again, magnetism is not an easy subject to deal with quantitatively, at the best, and under the simplest conditions. It might, therefore, be conjectured, in advance of observation, that the magnetic properties of different kinds of steel would be a particularly complicated subject and hard to unravel. One comfort to be found in this labyrinth of complex magnetic properties among alloys of iron is in the deduction that since the magnetic behavior of iron alloys does not at present admit of being predicted with any reasonable degree of precision there may be valuable discoveries in store for use in electrical engineering among the numerous alloys of iron that remain to be investigated in the future. For instance, it has only of recent years become possible to use a steel in telephone-receiver diaphragms that had less than ordinary electric conductivity, while not falling too low in magnetic conductivity, with the result that eddy-current losses in the diaphragm could be lowered and the volume of sound increased for a given telephonic current strength. Again, it is not so many years since it was found possible, for the first time, to produce soft steel castings of good permeability, thereby greatly aiding the tasks of the dynamo designer. A paper on "The Magnetic Properties of Some Manganese Steels of Definite Chemical Composition," by Mr. Ezer Griffiths, has recently appeared in the *Journal* of the Institution of Electrical Engineers. It deals with samples of steel of about 0.8 per cent carbon, varying proportions of manganese from 0.4 per cent to 5 per cent, with very low silicon, sulphur and phosphorus. The paper shows that the flux density that can be produced in these manganese steels falls off steadily as the percentage of manganese is increased, there being a marked fall after 1 per cent of manganese is reached. The sample containing 3.85 per cent of manganese showed a somewhat anomalous behavior.

LONG-DISTANCE TELEPHONY IN AMERICA.

Among the papers read before the recent Turin Electrotechnical Congress was one by Dr. F. B. Jewett on "Long-Distance Telephony in America," with special reference to the Bell system. The paper draws attention to the fact that in administering any large telephone system it is almost inevitable that scientific discovery and technical invention must outrun and lead industrial application. The successful use of any telephone system requires that the subscriber's apparatus must be uniform in construction and performance throughout. It must be of a certain standard quality. This, again, calls for the maintenance of specific standard conditions in the lines, switchboards and the plant as a whole. On the other hand, all improvements must present themselves as variations from the norm. An improvement has to be very marked in character before it can justify the displacement of some element, or elements, throughout the system. The larger the system the greater its inherent inertia and the greater the difficulty and cost of introducing changes. Reference is made to the recent extension of industrial long-distance service from New York City to Denver, a distance of 2100 miles, and confidence is expressed in the belief that before very long direct communication will be available between New York and San Francisco, a distance of 3500 miles.

Except perhaps Asiatic Russia, there is no country so well adapted to the ultimate development of very long-distance telephone communication as North America, because the need for such very long-distance communication can develop only in a country of great length, in which one and the same language is spoken throughout, and in which the business needs of the country will justify the expense of the long-distance telephone construction. Geographically speaking, there would be more opportunity for the development of very long lines in a north-and-south rather than in an east-and-west direction, because cities lying far apart on the same meridian of longitude have naturally a common business day, with respect to solar time, whereas at the same distance apart on the same parallel of latitude the number of hours common to the same business day is necessarily reduced. The five hours' difference of time between New York and London does not limit telegraph traffic between them nearly so much as it would limit telephone traffic, assuming that the latter were possible.

Graduates from Electrical Courses in the United States.

Our issues dated July 27, 1907; Dec. 26, 1908; Feb. 10, 1910, and Dec. 22, 1910, contained statistics relating to the graduates from schools in the United States conducting systematic courses in electrical engineering, and below are given the data compiled from our fifth annual census of these schools. Compared with the results of the fourth census, there are indicated an increase of five in the number of schools, an increase of ninety-seven in the number of enrolled students and an increase of sixty-five in the number of graduates. However, two of the schools numbered in the present list appear to have practically abandoned instruction in electrical engineering, so that the net increase has been three instead of five schools. The total number of students recorded includes not only those taking the regular four-year course, but also certain short-course men and certain others taking post-graduate work. The census returns show that 168 students continued their studies beyond four years, with the expectation of receiving an engineering, master's or doctor's degree. It would thus seem that one student out of every ten becomes a candidate for an advanced degree.

TABLE I.—ELECTRICAL ENGINEERING STUDENTS AND GRADUATES.

	Number of Schools.	Students 1910–11.	Graduates 1911.	Total Graduates to June, 1911.
Class I	25	3,344	633	8,752
Class II	69	4,228	678	6,066
Class III	15	1,566	299	2,499
Totals	109	9,138	1,610	17,317

TABLE II.—COMPARISON OF STATISTICS FOR FIVE YEARS.

Year	1907	1908	1909	1910	1911
Number of students	8,929	9,651	8,670	9,041	9,138
Number of graduates	1,358	1,501	1,473	1,545	1,610

As indicated in Table I, the schools have been grouped into three separate classes. Class I includes the schools of highest standing, the degrees from which confer more or less prestige on the graduate. Class III includes those schools in which the instruction is quite elementary, but which have regularly organized courses in electrical engineering. All other recognized schools giving complete courses of instruction in electrical engineering are included in Class II. During the past year there has been no change in the number of schools listed in Class I; there has been an addition of four to Class II and of one to Class III.

In estimating the number of students receiving less than four years' instruction, the estimates shown in Table III have been prepared on the basis of the percentages used last year. With a total of 17,300 graduates to date it can be assumed that about 36,800 entered the freshman class, of whom 19,500 received only one, two or three years of instruction. About 82 per cent of the freshmen become sophomores, 65 per cent juniors, 50 per cent seniors, 47 per cent graduates and 5 per cent post-graduates. It cannot be assumed that the short-course men are as a body of lower mental caliber than the graduates and post-graduates, for many of them have risen to positions of prominence in the industry. The industry owes a considerable debt to the engineering schools for the training received by these men.

TABLE III.—ESTIMATED NUMBER OF STUDENTS FOLLOWING LESS THAN A FULL COURSE.

	1907	1908	1909	1910	1911
Less than one year	520	580	560	593	617
One year	490	540	530	561	576
Two years	435	480	475	503	524
Three years	87	99	92	97	101
Less than four years	1,532	1,699	1,657	1,754	1,818

Opinion Sustaining Right to Fix Resale Price of a Patented Article.

Judge Coxe of the United States Circuit Court of the Southern District of New York handed down an opinion on Nov. 3 in a suit which involved the issue whether the owner of a patent can fix the price at which the patented article may be resold. The suit was between the Waltham Watch Company and a New York jeweler, and the court defined the issue concretely as follows: Is a retailer who purchases from the complainant a "Riverside movement" with instructions not to sell the same for less than $25 liable in equity if he sells for less than that sum? The opinion of the court is that this question must be answered in the affirmative. Many of the authorities, the opinion states, have gone much further in sustaining the right of the owner of a patent to impose conditions upon those who seek to use his monopoly. In support the cases are cited of the Heaton Peninsular Company, the Victor Talking Machine Company and the Crown Cork & Seal Company; and, as indicating the opinion of the court as to the limits within which the doctrine of contributory infringement should be confined, reference is made to the case of Cortelyou versus Johnson.

This opinion is quite at variance with the decree of the court in the Cleveland incandescent-lamp cases. In these cases Judge Killetts held that, while any of the defendants lawfully owning patents may grant to others or receive appropriate manufacturing licenses under such patents, upon terms and conditions fixed only by the licensor, such licensor, however, is enjoined and prohibited from requiring or imposing upon the licensee the fixing of a resale price to be observed by the licensee's vendees; and it was ordered that purchasers of such lamps from either licensor or licensee, or from vendees of either the licensor or licensee, whether at wholesale or retail, shall not be in any manner restricted as to the price at which such lamps shall be sold to the public or to any dealer or consumer.

Association of Railway Electrical Engineers.

The fourth annual convention of the Association of Railway Electrical Engineers was held in the Hotel La Salle, Chicago, Nov. 7 to 10. In connection with the convention the Railway Electric Supply Manufacturers' Association held an exhibition in a room near the convention hall. This consisted of twenty-nine attractive exhibits, nearly all of the lighter types of electrical apparatus used in connection with railroad equipment. The Manufacturers' association also took entire charge of the entertainment program, and on Monday evening before the actual opening of the convention there was a pleasant informal reception and dance in the Red Room of the hotel.

Mr. J. R. Sloan, of Altoona, Pa., made a brief address on Tuesday morning in which he spoke of courtesies extended to the president of the association by the Illuminating Engineering Society and the National Electric Lamp Association. He also referred to the fact that the United States government, through the Bureau of Standards, has issued a call for a conference on the standardization of incandescent lamps. Through the Pennsylvania Railroad the association has been invited to take part in this conference. Mr. Joseph A. Andreucetti, of Chicago, secretary-treasurer, presented his report, showing a total membership of all classes of 551.

A communication was received from Mr. L. Gutmann, of the St. Louis Section of the American Institute of Electrical Engineers, asking the co-operation of the association in urging the President of the United States to call the attention of Congress to the need of a permanent commission or government department to establish adequate super-

vision of patents, copyrights and trademarks, to the end that a patent may have an intrinsic value when issued. Mr. A. J. Farrelly, of Chicago, electrical engineer of the Chicago & Northwestern, said that the patent laws of this country need revision badly, and on his motion it was voted that the association follow the recommendation of the St. Louis Section of the A. I. E. E.

Mr. W. A. Del Mar, of New York, had written a letter to the association in relation to the terminology of electrical conductors, recommending that the various societies interested agree on a set of definitions, to be based on current practice and to be adopted as authoritative under the sanction of the American Institute of Electrical Engineers. Mr. Del Mar presented a set of definitions of such words as "wire," "strand," "conductor," "cable," "duplex cable," etc., and asked for their adoption if the society found them satisfactory. By vote the association expressed itself in favor of the standardization of the terminology of wires and cables and declared its willingness to co-operate with the A. I. E. E. in bringing about uniform definitions. Definitions offered by Mr. Del Mar were referred to the committee on standards, of which Mr. D. J. Cartwright, of Phillipsburg, N. J., is chairman.

There was some discussion of the matter of amending the constitution in relation to the manner of voting on changes in standard practice. A committee consisting of Mr. Cartwright, Mr. C. R. Gilman, of Milwaukee, and Mr. H. G. Myers, of Chicago, appointed to consider the matter, recommended that each senior active member of the association shall have one vote at meetings of the association on the question whether proposed changes shall be referred to a letter ballot of the members of the association. If this letter ballot is taken, however, in relation to proposed standard practice, only the ranking senior active member of the association connected with each railroad company shall have a vote, and the weight of his vote shall be in proportion to the number of electric-lighted cars operated by his company. This provision is intended to insure that the changes in practice shall be made only by those most vitally interested, and that the votes shall be in proportion to the extent to which each railroad company would be affected.

The constitution was also amended in relation to the matter of dues and payment of dues, and the first session was adjourned. A report of the remaining sessions, including the reports of the committees and the reading of papers, will be given next week.

World's Largest Turbo-Generator Placed in Operation.

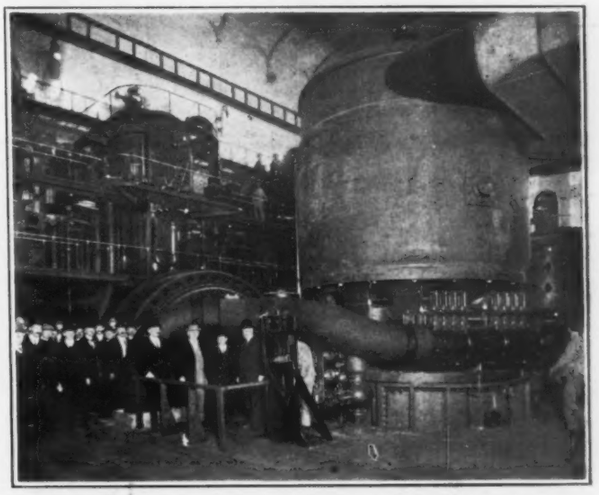
The first of the three 20,000-kw turbo-generator sets being installed in Waterside Station No. 1 of the New York Edison Company, at Thirty-eighth Street and East River, was officially placed in service on Nov. 3. The ceremonies incident to the starting were witnessed by a number of prominent engineers and a group of newspaper men, and in order to bring out more forcibly the capacity of the monster turbine the load from seven 3500-kw reciprocating engines similar to those displaced to make room for the three 20,000-kw turbines was transferred step by step to the turbine. The seven units, of course, were not all operating under maximum load, but this method of presenting the relative capacities of the engines and turbine was most impressive.

As described at length in our issue of May 25, 1911, the substitution of these 20,000-kw units for four of the reciprocating units necessitated the rebuilding of the greater part of Waterside Station No. 1. This work involved not only great changes in the steam equipment but also the redesign of the south and west side mezzanine floors housing the switching and control apparatus.

The generators are of the four-pole, three-phase, 25-cycle type, wound for 6600 volts. The normal speed is 750 r.p.m. They are direct-connected to six-stage Curtis turbines, designed to operate on 175-lb. gage pressure, with a back pressure of 1½ lb. absolute in the exhaust chamber, and with steam superheated to 100 deg. Fahr. The steam consumption in pounds per kw-hour under these conditions is guaranteed to be as follows:

Load, in Kilowatts.	Steam, Pounds per Kw-Hour.	Total Steam per Hour, Pounds.
10,000	15	150,000
15,000	14.4	216,000
20,000	15	300,000

The dimensions of the base of the machine are 17 ft. 6 in. by 17 ft. The height above the base is 35 ft. 7 in., and the height of the foundation above the basement floor is 10 ft. Each machine weighs approximately 420 tons, the revolving parts weighing 112 tons and the heaviest piece 110 tons. The runners are 13 ft. in diameter, and the total number of buckets they contain is 7200. It is interesting to note that the area occupied by one of the 20,000-kw units is 297 sq. ft. The area occupied by the single 3500-kw engine-generator unit of the type displaced is 918 sq. ft., so that, judged on this basis, the turbine generates approximately eighteen times as much power as the reciprocating engine per unit of area occupied.



20,000-kw Unit in New York Edison Waterside Station.

Assuming that the turbine is fully loaded all day and an evaporation of 9 lb. of water per 1 lb. of coal, the unit will require 7,200,000 lb. of steam a day, and about 400 tons of coal. To condense the steam 86,000,000 gal. of water will be required. For cooling the generator windings each unit requires 80,000 cu. ft. of air per minute or approximately 115,000,000 cu. ft. a day.

In order to bring out more fully the size of the unit, it might be stated that it has more than sufficient capacity to supply the entire State of Delaware with the electric service at present meted out by the various public-utility companies in that State. It is also large enough to meet the electrical wants of a state like Wyoming. For more detailed information on the unit, its condensing and switching equipment, the reader is referred to the issue of May 25, 1911, when all the changes incident to the substitution of the 20,000-kw units for reciprocating-engine units were fully described.

Gas Statistics.

The Census Office has just issued a preliminary statement of the census taken in 1909 of establishments engaged in the manufacture of gas, illuminating and heating. The total number of establishments was 1296. In 1907 the total number of central stations was 4714. The increase of gas plants during the previous five years was 27 per cent, or nearly the same as for all central stations, the figure for the latter being 30.2 per cent. If, however, the municipal electric-lighting plants are neglected, the increase of gas plants was the larger, the figure for central stations aside from municipal plants being 23.4. The capital invested in gas plants was $915,537,000, or somewhat less than in central stations in 1907, the cost of construction and equipment of the latter being reported at $1,096,913,622. The value of gas products was $166,814,000, which was somewhat less than the gross income of central stations for 1907, which was $175,642,338. The number of salaried officials and clerks was 13,515, and that of wage earners 37,215. The corresponding figures for central stations in 1907 were 12,990 and 34,642.

Naval Pageant at New York.

A naval review ending with a parade on Nov. 2 of twenty-four battleships accompanied by a flotilla of protected cruisers, gunboats, torpedo boats, submarines and tenders was held in the harbor of New York last week. The total of all vessels was 102, forming the greatest fleet of American warships ever mobilized in the history of the United States.

The official ceremonies in connection with the mobilization of practically all the vessels of the navy in Atlantic waters began on Nov. 1, when Mr. George von L. Meyer, Secretary of the Navy, accompanied by the members of the Senate and House committees on naval affairs, inspected the fleet as it rode at anchor in the Hudson River off Riverside Drive. On Thursday afternoon the fleet was reviewed by President Taft as it proceeded to sea. During the week spectators on the shore at night were treated to a magnificent electrical display. The ships at anchor were outlined in electric light and the numerous searchlamps with which the fighting ships are equipped were also brought into play. The accompanying illustration shows the ships as they appeared on the evening of Nov. 1, but does scant justice to the spectacle. It will be understood, of course, that the boats were anchored some distance from the shore and in a line 6 miles long. It is also rather difficult to obtain a satisfactory photograph of illuminated ships, which, although at anchor, swing with the tide or move with the waves. While the absence of fireworks made the view less spectacular than that afforded by the Hudson-Fulton celebration a few years ago, the scene was nevertheless impressive.

Illuminated Battleships at Anchor in the Hudson River.

Commonwealth Edison Section, N. E. L. A., Takes a Night Off.

The fourth annual banquet of the Commonwealth Edison Section of the National Electric Light Association, given at the Hotel Sherman, Chicago, on the night of Nov. 1, was a truly remarkable affair. It partook partly of the nature of the annual frolic of the section, but it was also made the vehicle for impressive words of serious purpose. The dinner and the "doings" consumed five and one-half hours, and there were 850 men present, but every man was keenly interested until the last.

It would take too much space to give an account of all the "stunts" that were performed. In general, the revels were conducted under the direction of an unseen personage known as "Queen Electra." She sent in her messenger, loaded with instructions and paraphernalia, and designated Mr. A. D. Bailey as her "starting engineer," an office that corresponded to that of toastmaster, with enlarged duties. Mr. Bailey was distinguished by an impressive crown, electrically lighted from within, and so he presented a striking appearance when the room was darkened, as it was at intervals. There were other electrical effects and numerous vaudeville acts, cartoons and photographs on a screen, hits at well-known members, singing of parodies of popular songs, amusing "rube warblers," the music of the really fine orchestra of the organization, and several other forms of entertainment. The whole affair was notable from the fact that every man who took part in it was an employee of the Commonwealth Edison Company, and the spirit of enthusiastic good-fellowship was manifested in a very convincing manner.

The diners were seated at round tables, and one of the ideas carried out was an emulation of the generous cooperation of the Knights of the Round Table in King Arthur's court. It will be remembered that the magazine issued by the Commonwealth Edison Section bears the title *The Edison Round Table.*

The retiring chairman, Mr. Ernest F. Smith, when called upon by the starting engineer, reviewed the work of the year. He said that the members in the section now number 1299, an increase of 812 since the banquet of a

year ago, when the membership stood at 487. Mr. Smith thanked the other officers and his loyal committeemen, especially Mr. P. Junkersfeld, chairman of the membership committee, for their very effective work in the history of a successful year. However, he said, there is still much to be done in increasing the membership, as it is estimated that the section contains but 58 per cent of the employees of the company eligible for membership. Mr. Smith extended his most cordial good wishes to the incoming administration, the personnel of which was not known at the time he spoke, for one of the features of the banquet was announcing the new officers, the results of the election having been kept secret.

A pleasant feature was the presentation of a handsome rosewood gavel, suitably inscribed on a gold band, to the retiring chairman. Mr. H. L. Gannett made this presentation.

After a number of amusing mock regrets had been read by the starting engineer, that functionary handed to Mr. Smith a formidable document which contained the names of the successful candidates. Mr. Smith broke the seal and announced that the section had chosen the following officers : Chairman, Mr. R. F. Schuchardt; vice-chairman, Mr. W. C. Berry; secretary, Mr. C. B. Crothers; treasurer, Mr. William A. Fox; executive committee, Messrs. W. J. Dooner, W. Wardell and F. A. Kaup. Then there was more singing and enthusiasm and special verses of greeting. Mr. Schuchardt made an earnest speech in accepting the responsibilities of his position, and with the growth of the section the position of chairman is a responsible one. He announced that the general subject of the meetings of the coming year would be the relations of the public-service corporation to the community it serves, and that these large questions would be discussed by members and non-members of the section. Mr. Schuchardt, in the course of his speech, gave this carefully considered definition of a public-service corporation: "A true public-service corporation—and this definition fits ours—is an organization of trained individuals whose efforts are directed toward utilizing capital to produce for a community, as cheaply as possible, a commodity the use of which improves the living and working conditions of that community, and in so doing earns for those individuals a return for their labors and for the capital employed a return for its use. In other words, it is an organization which uses capital to provide a convenience or a necessity, and which, in order to justify itself, must provide this cheaply, and therefore must produce efficiently."

Three Knights of the Round Table were featured on the program. They were Messrs. Samuel Insull, Louis A. Ferguson and John F. Gilchrist. Mr. Insull and Mr. Ferguson are past-presidents of the N. E. L. A., and Mr. Gilchrist is the president this year. The first of these to be called on was Mr. Ferguson, who explained that he was wholly under the dominion of Queen Electra, and that he had been directed not to make a serious address. In its stead, after commenting on the unusual nature of the program, Mr. Ferguson recited a poem, "The Knight's Toast," with fine effect.

After a vote of thanks to the N. E. L. A. orchestra had been passed, Mr. Insull, the president of the company, was called on as the greatest knight of all those in the service of mighty Electra. Mr. Insull, as well as Mr. Ferguson and later Mr. Gilchrist, received a great ovation. He spoke impressively and with deliberation. Last year he expressed the hope that the section would double its membership, but it had gone away beyond that. The great importance of the N. E. L. A. was explained. In unity there is strength, and the executive officers of the company could not have attained the success they have without the loyal support of the committees of employees. The company section is a continuation of the same idea. It gives an opportunity to exchange ideas, and the benefit of co-operation exists all the way down the line. The day may come when membership in the company section will be viewed as the first evidence of a man's desire to be useful to the company and to himself. Positions of responsibility in the electrical industry are necessarily increasing in number, and membership in the N. E. L. A. is a great aid to the young man in fitting himself for these positions.

Mr. Insull alluded to the fact that he had been nearly twenty years in the service of the company, which has grown so that it has been unable to keep in touch with every member of the organization. "Nevertheless," he said, "I like to feel that I am one of you." There is as great an opportunity in the electrical industry to-day as there ever has been, and Mr. Insull cited the example of Mr. Gilchrist, who started in with the company as an office boy and is now president of probably the greatest electrical society in the world. There is no reason why others should not succeed as Mr. Gilchrist has done, especially as the capital of the country flows more easily into the industry now than it did fifteen or even ten years ago. The speaker dwelt earnestly also on the influence of the N. E. L. A. in the direction of the personal welfare of its member companies and their employees, referring to the work of the public policy committee. Referring to the saving fund of the Commonwealth Edison Company, he announced that at present this fund has invested $110,000 in the company's securities and the fund is increasing at the rate of about $5,000 a month. At the end of the first five years of its existence it will amount to probably more than $500,000, which will be invested in the business. The president of the company urged the benefits of this saving fund on his hearers in words that will be remembered. There is no better way to save money, he said, than to invest it in the business in which you are engaged if you believe in that business. The company is anxious to encourage the largest possible ownership among its employees.

The interesting announcement was made by Mr. Insull that a pension fund would be established by the company, and it was hoped to get it in operation in the next few months. Speaking of the future, Mr. Insull said he believed the progress made by the company so far is small compared to what the future will show. The Commonwealth Edison Company has had peculiar opportunity in massing the production and distribution of electrical energy, reducing cost as a result of that policy, and giving alike to the small consumer and the large consumer the advantage of very cheap energy. The outlook is as bright as it ever has been. The trend of events shows that the production and distribution of energy in this great country will be done in mass, as it is to some extent in Chicago, and that the wheels of commerce and industry will be turned by energy supplied by central stations relatively few in number considering the large area of the country. Great possibilities will be brought to actuality, and Mr. Insull concluded by appealing to the young men present to do their part and secure the reward that comes to constant, intelligent service.

Mr. Gilchrist, president of the N. E. L. A., said that it was rather a curious coincidence, in view of all the nice things that had been said about everybody, that the banquet was held on All Saints' Day. He expressed his appreciation of the honor of the presidency of the N. E. L. A., and told in earnest words how he relied on the support of the membership. He commented on the size and significance of the gathering before him and the wide area covered by the Commonwealth company and its neighbor companies. He also spoke of the versatility of the men in the organization and expressed his great pride in it. He also made the interesting statement that two-thirds of the regular income of the N. E. L. A. comes now from Class B members. He spoke of similar company sections in various other cities and said that they were all of the same class of "live wires" as the men he was addressing. Every man in the industry should feel his responsibility to it, and Mr. Gilchrist spent

a little time in enlarging on the text, "Neglect not the gift that is in thee."

The banquet, with its alternating shades of grave and gay, was a most elaborate and successful affair. A great deal of hard, painstaking effort was necessary for the preparations, and appreciation of good work is due to Mr. R. F. Schuchardt, chairman of the banquet committee, and his associates on the committee, Messrs. A. D. Bailey, Guy Lunn, H. L. Gannett, E. H. Lakeman and E. J. Doyle. Among the others who contributed to the success of the occasion, either as writers, illustrators or performers, were Messrs. H. A. Seymour, W. A. Durgin, A. R. Gerlach, W. H. Ott, C. G. Axell, R. A Fischer, Harold Wright, William R White, R. R. Pilkington, M. R. McGovern, O. J. Bushnell, H. E. Addenbrooke, W. H. Childs, A. E. Evans, M. L. Eastman and Charles A. Lind.

Boston Edison Company Entertains Municipal Authorities.

The Edison Electric Illuminating Company, of Boston, Mass., recently entertained about 125 municipal officers from the thirty-eight cities and towns of its territory at a luncheon in the assembly hall of the main office building in Boston. A feature of the occasion was a greeting by President C. L. Edgar, after which a short address was delivered by Hon. E. W. Burdett, general counsel for the company. Mr. Burdett emphasized the unusual conditions of harmonious relationship between the company and the municipalities in which it operates, which made the luncheon and its cordial acceptance possible. He reviewed the growth of the company, pointing out the reductions in rates during its life from 25 cents to 11 cents per kw-hour, and contended that such a reduction during a period characterized by no little development and experimentation in the art calls for little urging from public officials. The average income has dropped from 13 cents to about 6 cents per kw-hour. Mr. Burdett pointed out that the policy of placing wires generally underground cannot be established in suburban territory on account of the enormous expense involved, which would inevitably raise the rates to prohibitive figures. An informal discussion then took place, in which the company sought criticisms of its policies and service from those present, meeting these frankly in a spirit indicating its effort for improvement. At the conclusion of the meeting the party was taken to the L Street station in South Boston, where the new 15,000-kw turbine installation was examined, and the rest of the day was devoted to informal good-fellowship, terminating in a theater party. The affair was the second of its kind in the history of the company and accomplished much in the way of securing a better understanding of the aims and policies of the participants.

Cleveland Central-Station Situation.

The proposition to issue $2,000,000 bonds for the construction of a municipal electric plant in Cleveland was carried at the general election last Tuesday. The Cleveland Electric Illuminating Company fought the project; but without avail. However, the points in opposition raised by Mr. Samuel Scovil before the Cleveland Chamber of Commerce are of interest.

The point of view of the citizen and taxpayer is the real question to be considered when an issue of this character is presented. Mr. Scovil said that the service rendered by the company was excellent and that there had not been a complaint that the company had failed to meet the growing needs of the city. Regarding statements as to the average cost of energy to consumers, Mr. Scovil said that in 1910 out of the total energy billed to 28,000 customers, consisting principally of residents subject to the maximum rate, less than one-fourth was billed at the maximum rate, while over three-fourths was billed at 5 cents per kw-hour, making the average cost 6.88 cents per kw-hour.

The City Council of Cleveland passed an ordinance in 1893 fixing the maximum rate for electricity. Every reduction since that date has been made voluntarily by the company. So far as the great bulk of customers are concerned there has been a reduction in the price of electricity during the last ten years of 42 per cent. The system of rate-making adopted by the company is one that has been approved by students of electrical service and expert public-service commissions, sanctioned by state and federal courts and sustained by universal practice. If electricity can be sold to all consumers in the city of Cleveland at any such low price as 3 cents per kw-hour, the rate the advocates of the proposed municipal plant have talked of introducing, why has no public or private plant in this country or abroad ever succeeded in approaching this figure?

Taking up the subject of valuation, Mr. Scovil said that the report of the company to the Tax Commission of Ohio showed the cost of the property as of Jan. 1, 1911, to be $10,679,000. The Tax Commission valued the property at $11,375,000. The difference is represented by working capital of the company, such as stock supplies on hand, accounts receivable, etc. The company had outstanding on Jan. 1, 1911, a total of $4,100,000 bonds, $800,000 preferred stock and $5,734,500 common stock. During the seventeen years that Mr. Scovil has been connected with the company it has never sold a share of its stock for less than par, and the bonds which it now has outstanding were sold on a 5¼ per cent interest basis. The company has never indulged in any stock-inflating consolidation. Its plant, Mr. Scovil said, cannot be duplicated either by private capital or by the city at the price at which it stands on the books, and the company is ready to offer every facility for complete proof of this statement.

Concerning campaign statements in regard to earnings, Mr. Scovil said that for the year 1910 the net income was $843,429. There were included in the operating expenses $209,772 for depreciation and an employees' fund. This amount is equal to less than 2 per cent of the plant investment fund. If there is any criticism of this amount it is that the sum is too small rather than too large. From the net earnings there was paid to the stockholders and bondholders in interest and dividends an amount equivalent to 6.3 per cent on the investment. This consisted of 5 per cent to the bondholders, 6 per cent to the preferred shareholders and 8 per cent to the common stockholders. The surplus after these payments was $173,655. In the eighteen years of existence of the company the stockholders have received an average of not more than 7 per cent on their investment, and, taking the total of bonds and stock, there has been distributed to bondholders and shareholders an average of less than 7 per cent.

In conclusion Mr. Scovil declared that if the situation demanded public action the State had created a public-service commission designed to consider in an impartial and judicial manner all such controversies. The Cleveland Electric Illuminating Company has a right to expect those in control of the city affairs to protect its property in the same manner and in the same degree as they would the property of any other citizen. The people who have invested in the securities have made the investment on the assumption that as long as they dealt fairly with the community that the investment was to serve the community would also deal fairly with the investment. The company understands fully and has never questioned the right of the people to regulate honestly its operation. In standing ready to offer every facility for the proof of the statement that the equipment has been so built with economy and planned for economical operation that it cannot be duplicated to-day for the price on the books, the company

realizes that in so far as an inventory and complete audit of the property and books will not sustain the claim that the property which is used and useful for the service of the public has a value equal to the cost it must accept the consequences. It must furnish its service on rates which will be based on a lower valuation if such lower valuation be the result of the inventory.

Train-Lighting Instruction Car Put in Service by the Pennsylvania Railroad Company.

Continuing its policy of instructing employees in their several lines of duty, the Pennsylvania Railroad Company has just placed in service a "train-lighting instruction car." The Pennsylvania Railroad has at this time no less than eight distinct axle-device systems, in addition to the large number of straight storage equipments, and the instruction car will offer an efficient means of furnishing uniform instructions to yard electricians. The present intention is that the car shall be sent to the different points at which electrical forces are maintained, and the men at such points shall be given lectures and demonstrations on the operation and maintenance of the various equipments. For this purpose a car was selected and has been remodeled to suit the requirements.

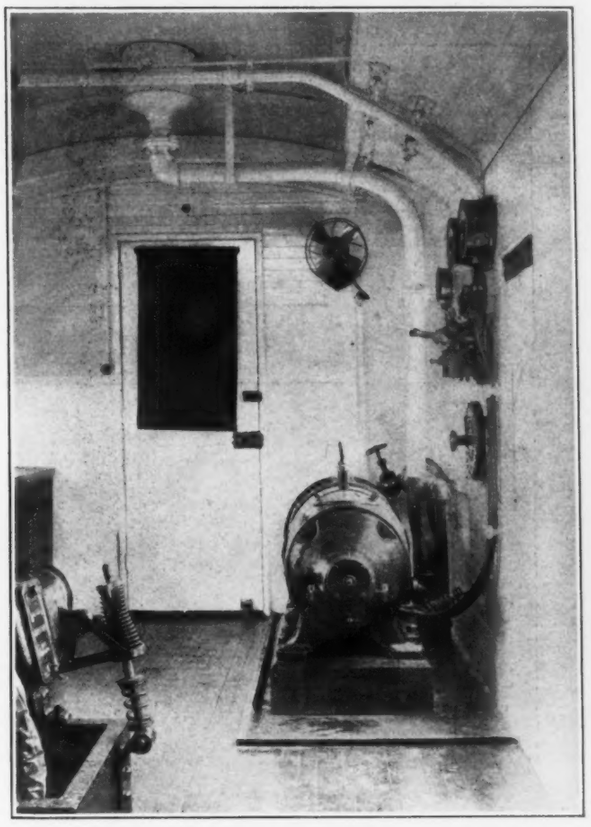


Fig. 1—Turbo-Generator Set.

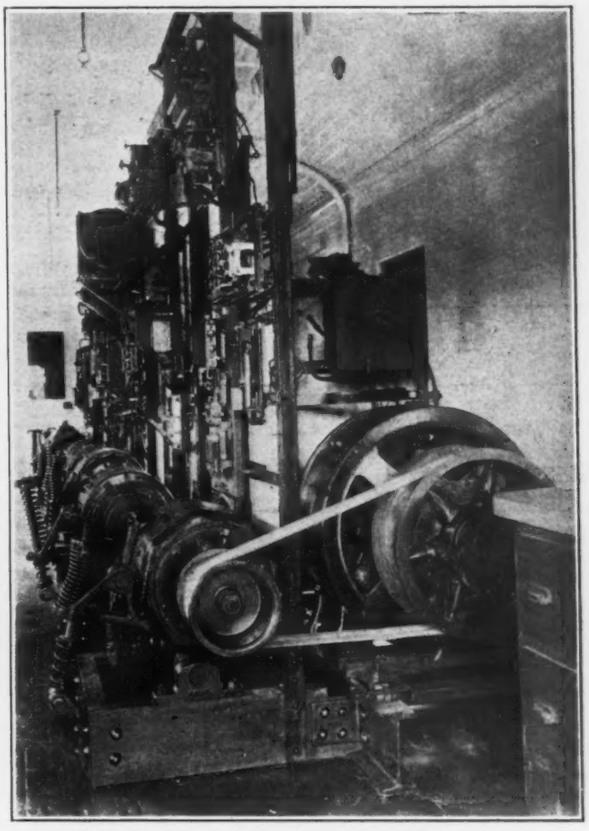


Fig. 2—Two of the Axle Generators, with Driving Motor.

The apparatus installed consists of a 32-cell storage battery, a 15-kw Curtis turbo-generator, a variable-speed motor with necessary controlling apparatus for driving the axle devices and the following axle generators with their regulating equipments: Newbold, Moskowitz, Bliss, Consolidated, Safety and Gould. One end of the car has been partitioned off and equipped as an office and sleeping quarters for the instructor.

The storage battery is placed within the car in order that the cells may be used in demonstrating as well as for lighting the car. The usual battery boxes under the car are omitted. The battery closets are lined with sheet lead and arranged with ventilators through the car roof to conduct away the gases and fumes given off when the batteries are on charge.

Fig. 1 shows the 15-kw turbo-generator set, as formerly used on all Pennsylvania limited trains. In this case the usual switching devices are replaced by two single-pole automatic circuit-breakers, giving both overload and underload protection to the machine. The field rheostat and motors are seen mounted on the side of the car. Connections are such that the turbo-generator can be used for driving the motor, charging the batteries and lighting the car, though under ordinary conditions the motor will be driven from yard power lines.

On account of the limited space it was impossible to photograph the entire line of axle generators; consequently these were "taken" in pairs, one of which is shown in Fig. 2. The generators used in the instruction car are mounted on rocker shafts and are equipped with springs for regulating the belt tension, as is done in actual service. Immediately back of each machine is an angle-iron framework on which is mounted the corresponding regulating apparatus, the equipment in each case being identical with that installed on passenger cars.

Each generator is connected through suitable switching devices to the lamp load and batteries, enabling the operator to demonstrate the apparatus under all conditions of load. The lamps used for this are banked in porcelain receptacles on the ceiling of the car.

The driving motor is of the interpole type and is mounted on an iron framework equipped with rollers, which enable the operator to move the motor equipment along an I-beam track for belting up to any one of the six generators, as shown in Fig. 2. The control panel for this machine is

secured to the movable framework and moves with the motor. The motor-starting rheostat is on the rear of the panel, and the front is equipped with two single-pole main switches, double-pole reversing switch, circuit-breaker and inclosed carbon pile, used as a field rheostat. A combined fuse and switch receptacle is installed, through which the motor is connected to the power circuit, there being several such receptacles spaced at suitable intervals along the side of the car.

The operator's office contains a folding couch, an upper berth, a clothes closet and a toilet, the finish throughout being white enamel. With the instruction car in operation it is intended that all employees whose duties have to do with the car lighting shall be instructed in the care and operation of the various equipments, with the twofold object of educating those interested and securing uniformity in their work.

Tungsten-Tube Furnace.

An ingenious design of an electric tungsten-tube furnace developed in the Research Laboratory of the General Electric Company is described in a patent granted to Dr. Axel Appelberg on Oct. 24. The furnace is especially suitable for the heat treatment of metallic filaments. The heating element consists of two tungsten tubes connected in series. They are mounted in tungsten bushings with copper terminal blocks and water-cooled brass-tube connections. By means of a spiral-spring arrangement a tight contact is always maintained between the tungsten tubes and the terminals. To concentrate the heat in the interior of the tungsten heating tubes (where the heat treatment of the filament is carried out) each heating tube is surrounded by a cylindrical heat-reflecting screen, consisting of two concentric tungsten tubes, with an alumina packing in the open space between the two tubes.

The whole furnace construction is air-tight, so that the atmospheric pressure in it may be regulated and the furnace be used, for instance, as a vacuum furnace. This arrangement permits control of the chemical nature of the atmosphere, since, for instance, a hydrogen atmosphere may be maintained in it. It is evident that a furnace of this type can be calibrated as to temperature and that any particular condition of temperature, etc., can be duplicated with certainty merely by regulating the current supply, the gas supply, the degree of exhaustion, etc.

The furnace is operated by alternating current, and temperatures almost up to the melting point of tungsten, which is over 3000 deg. C., can be attained. For 9-in. tungsten tubes with an internal diameter of 2 in. and a thickness of ⅛ in. a current of 5000 amp or even more may be used.

(In the note on tungsten-tube furnaces in our issue of Nov. 4, page 1100, reference was made to the design of Winne and Dantsizen, who were stated to use an "aluminum" tube wound with ductile tungsten foil. It is hardly necessary to say that "aluminum" was a printer's error for alundum; that is, electrically fused alumina.)

Revised Rubber-Covered Wire Specifications for Chicago.

Mr. William Carroll, city electrician of Chicago, has issued an announcement in which he gives notification that the new specifications for rubber-covered wire will be enforced by the department of electricity of the city of Chicago as follows: After Jan. 1, 1912, all wires in sizes from No. 14 to No. 0000, B. & S. gage, must comply with the new specifications to pass inspection by the city of Chicago. After July 1, 1912, all wires in sizes from 250,000 circ. mils must comply with the new specifications. However, on all contracts signed previous to the date of the issuance of this notice—that is, Sept. 5, 1911—wire complying with the then existing "municipal specifications" may be used, provided that all such contracts are listed with the department of electricity within fifteen days from the date of the notice.

Turin International Electrical Congress—II.

Abstracts of only part of the eleven papers dealing with construction, central stations, switchboard and distribution, forming Section II of the Turin International Electrical Congress, were printed in the Oct. 28 issue, owing to pressure on our columns. The remaining papers of the section are given in abstract below.

PROTECTION OF INSULATORS FROM POWER ARCS.

Mr. W. Weicker gave an account of recent developments in insulator design and showed a number of photographs of insulators under the arcing test.

Insulators should be designed with as large a margin as practicable between the arcing-over voltage and the puncture voltage and yet they must thoroughly insulate the normal potentials. Of course, it would be desirable to avoid arcing over, but practical experience has shown that this is impossible of attainment and, therefore, means of harmlessly dissipating the energy of the arc must be devised.

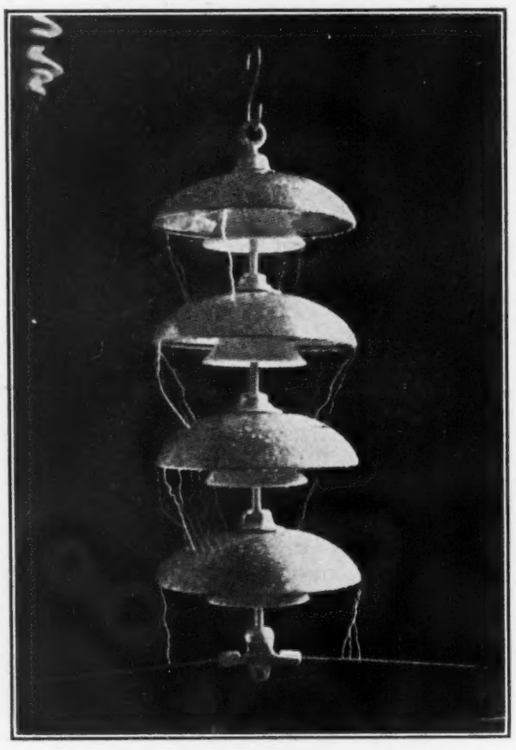


Fig. 1—Insulators Covered by Metallic Cap.

The arcing rings described by Mr. L. C. Nicholson before the A. I. E. E. (1910) and in the *Electrical World*, March 23, 1911, were referred to and photographs shown of such rings in operation, both on pin and on suspension insulators. They provide effective protection from the arc and have the advantage of being easily attached to any form of insulator.

The author points out that the metallic umbrella type of insulator recently introduced by the Porzellanfabrik, Hermsdorf, affords an even greater degree of protection

from arcing over and has the advantage of equalizing the dielectric stress. This metallic umbrella principle has been extended to fulfil the requirements of the suspension-type insulator and as a result of experimental research a quite new form of insulator has been produced. Each unit consists of a porcelain insulator covered by a metallic cap shaped like a bowl that comes down over the sides and almost completely hides the insulator. This metallic cap serves the following useful purposes: It equalizes the dielectric stress; it provides a path for arcs, allowing a harmless dissipation of their energy; it protects the porcelain from mechanical injury during installation, or from missiles; it shields the insulator from rain and snow. Tests showed that the relation between arcing distance and arcing voltage was practically uniform under dry and rain conditions alike and that the arcing voltage increased in practically direct proportion with the number of units.

REGULATION OF ELECTRIC GENERATOR UNITS.

The theory of regulation of electric generator units was comprehensively and succinctly treated in a paper by Mr. J. L. Routin.

Dividing all regulation into two classes—mechanical regulation of the torque of the prime mover and electrical regulation of the emf or current, as the case may be, of the generator—the author shows that the interrelations of mechanical and electric regulation are such that both should be used in all cases except in direct-current installations, where variations in speed are permissible. In these latter cases a potential regulator that operates by controlling the torque of the prime mover will serve every practical purpose.

The earliest mechanical regulator was invented by Poncelet in 1829. It operated on the dynamometer principle, being actuated directly by changes in the torque. However, there were fundamental defects in its theoretical and practical working which prevented it ever coming into extensive use.

The only other method of mechanical regulation is that in which the regulator is actuated by changes in speed. Taking up the fly-ball governor, the author exposed the underlying principles of operation. He then outlined the effects of inertia upon regulation and discussed in detail the action of a speed governor, including the effects of inertia and friction, using the diagrams devised by Mr. Léauté and used in his famous memoirs on long-period oscillations. In this analysis the author gradually leads up to a method wherein theoretically all oscillation is eliminated. In the second part of the paper, under electric regulation, the disadvantages of compounding were enumerated, and then followed a brief outline of electro-mechanical compounding, which can be attained with a special form of governor or regulator described in detail in the latter part of the paper. This improved form of governor permits a practically perfect compensation for inertia and may be applied to mechanical, hydraulic or electric regulators. Each type was briefly described.

A schematic diagram of the electric regulator is shown in the accompanying illustration. The electromagnet 3, in series with the circuit to be controlled, acts on the lever 1 against the spring 9. Excess current in the magnet 3 pulls down the lever 1, bringing the contacts 10 and 11 together and thus energizing electromagnet 13, which closes 19, starting the motor 23 that operates the field rheostat, the gates of a turbine, the cut-off of an engine or whatever mechanism it may be intended to control. The moment the motor circuit is closed contactor 26 also closes, energizing 29, which exerts a pull in opposition to the magnet 3. If the departure from normal condition is but slight the magnet 29 will pull up the lever at once and it will vibrate rapidly until the normal condition is restored, the motor turning a little each time, but if the departure from normal condition is great the magnet 3 will exert sufficient pull to hold the contact 10 closed against the constant pull of 29. It will be seen that this regulator acts at a rate which is proportional to the magnitude of the departure from normal conditions and in this manner oscillations are avoided and normal conditions are re-established with great rapidity.

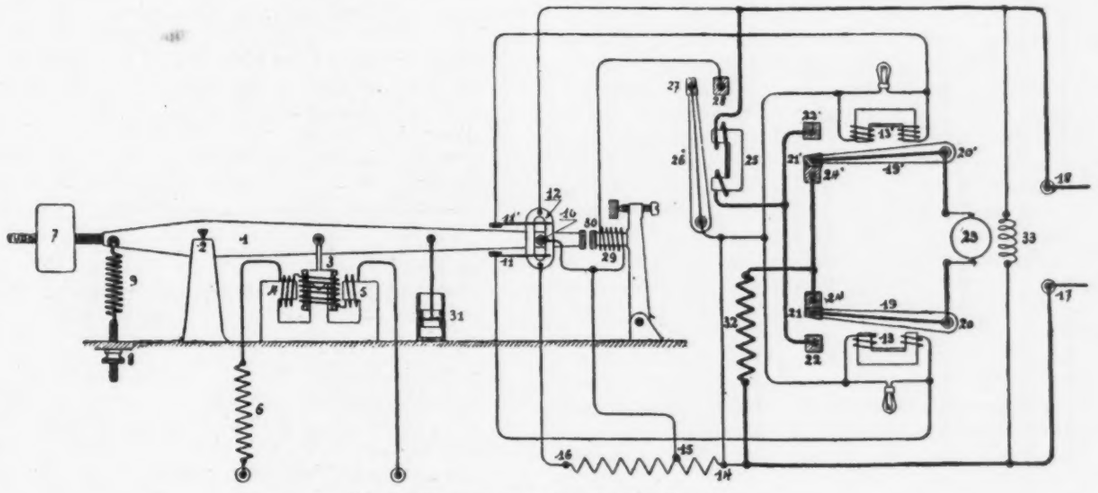


Fig. 2—Diagram Showing Electric Regulator.

This device can be used to regulate voltage or current and by connecting suitable reactance and resistance in the circuit in series with 3 and using a shunt transformer constant voltage can be maintained at any desired point on an alternating-current line. By employing a magneto to produce the current through 3 the regulators may be used to control speed.

The construction of the contacts to avoid rapid deterioration is quite remarkable. The contact 10 consists of a steel core plated with silver and the contacts 11 and 11′ are also of steel, plated with silver. The fixed winding 12 serves to magnetize these contacts. When the contacts approach each other the magnetic attraction tends to pull them together while the elasticity of the springs 11 and 11′ tends to oppose their being drawn together. As they come closer the magnetic pull increases very rapidly, while the spring pull decreases directly with the distance; therefore, they finally come together very suddenly and at a speed which is quite independent of the speed of movement of the main lever 1. Upon separating the same action takes place in reverse order; thus the magnetic attraction drags

the spring contact 11, or 11′, as the case may be, along with 10, until the elastic force increases sufficiently to overcome the magnetic pull, when the two fly apart. This magnetic pull between the contacts has an entirely negligible effect upon the motion of the main lever 1.

ALUMINUM AS CONDUCTOR MATERIAL.

A very comprehensive report on the present status of aluminum conductors in the art of electric transmission was submitted by Mr. E. Huber-Stockar. In the introduction the author refers to Mr. H. W. Buck's paper on the same subject before the St. Louis Congress in 1904, and to Mr. E. Dusaugey's paper before the Marseilles Congress in 1908. Although the paper is limited to the use of aluminum as a transmission conductor, a brief reference is made to its use in the construction of machine windings, and it is interesting to note that in 1899, when aluminum was so cheap in comparison to copper, twelve 200-kw transformers with aluminum windings were built by the Oerlikon company and are still in service. However, at present electric-machine design has progressed to a point where the price of aluminum could never be low enough to offset the effect of the large volume in increasing the cost of the machine as a whole.

When copper and aluminum are used together in the same system the greatest care must be taken to avoid the tendency of linemen to string aluminum as though it were copper, for it is only by proper installation that satisfaction can be obtained. Where aluminum and copper are joined together no trouble will be experienced from galvanic action if the joint is made watertight. The use of mechanical joints in place of solder is to be looked upon as an advance in line construction, and they should preferably be used in copper lines also. The principal reason for using aluminum in preference to copper is the saving in first cost. Mr. W. von Möllendorff has shown (1910) that on the basis of equal conductance aluminum can cost 1.92 times as much per unit weight as copper, and on the basis of equal heat dissipation it can cost 2.2 times as much. At present it costs only 1.11 times as much, and therefore for equal conductance will show a saving of about 30 per cent over copper.

The author next discusses the various reasons why European companies have been so backward in the use of aluminum conductors, and exposes the various prejudices that exist in the minds of some.

Taking up bare conductors first, the author gives the results of a number of recent tests on the corrosion of aluminum in moist air, salt air, salt water, various gases, acids, etc., and these results indicate that in respect to its chemical stability aluminum is in general the equal of copper. There has been much said about the tendency of electrostatic repulsion to reduce impure condensation on aluminum conductors, but the author rejects all such tales as unworthy of the slightest credence. However, in general, an aluminum conductor under given conditions is not likely to collect much more moisture than copper. With respect to heat absorption, the ratio of aluminum to copper of equal conductance is 1.2105 to 1 per unit weight and 0.932 to 1 per unit surface.

Bare aluminum conductors laid in the earth have been tried out in railway return feeders, with the result that they were rapidly corroded by galvanic action. Aluminum conductors for making connection in the power house have many advantages. The large conductors on account of their large radiation surface show a great saving over copper, and small conductors have the advantage of greater rigidity for a given conductance, and in high-tension installations, where it is desirable to reduce the number of points of support to a minimum, this is of special importance. In discussing the use of expansion joints in buses the statement was made that because of the greater surface the temperature rise for equal conductance would be less than with copper, and that because of this copper and aluminum buses were about equal as regards the use of expansion joints. In long spans it is likely that an aluminum alloy may prove to be of greater value than either pure aluminum or pure copper. The author gave considerable data on an aluminum-copper alloy, known under the name of spree-aluminum. It has nearly double the strength of pure aluminum. Its breaking length is 10.7 km, as compared with 10.3 km for steel, 6.7 km for aluminum and 5.1 km for hard copper. The use of spree-aluminum cable shows a saving of about 7.3 per cent as compared with copper cable of equal conductance. The extraordinarily great elongation of aluminum enables it to withstand severe overloads by stretching and thus increasing the sag. However, in dealing with wire this cannot be relied on, as a scratch or a single imperfection will often cause the wire to break without any appreciable elongation. For this reason cables are to be preferred to single-wire conductors. Aluminum cables do not show as great a saving over copper cables as exists in the case of wires. However, on the basis of present prices the aluminum cable shows a saving of about 20 per cent.

Instructions are given for stringing and joining aluminum wire and cable, the construction being divided into three classes—spans under 50 m, spans from 50 m to 150 m and spans greater than 150 m. In the latter part of the paper uses of insulated aluminum wires and cables are discussed. While these uses are naturally much more limited on account of the high cost of the insulation, it is nevertheless true that in the longer sizes with cheap insulation the aluminum may be cheaper than copper.

At the end of the paper the author gives a bibliography and several statistical tables on aluminum, copper and spree-aluminum wires and cables, as well as data on a number of Continental and American installations.

Public Service Commission News.

NEW YORK COMMISSION.

The Public Service Commission, Second District, has received and served upon the Buffalo General Electric Company the complaint of Frank C. Perkins, Erie County Bank Building, Buffalo, N. Y., objecting to the signing of a contract for service which contains a provision that in case the supply of energy shall fail, whether from natural causes or accident in any way, the company shall not be liable for damage to person or property resulting from the use of the electricity. Complainant also objects to the provision which prevents the use of any electrical conductors for light, heat and power purposes other than those connected with the company's mains. Under this requirement, complainant states, he will be unable to use a small gas engine and generator and conductors from same to the lighting circuit for auxiliary service.

The Public Service Commission, Second District, has received the petition of the Keeseville Electric Company for permission to execute a first consolidated mortgage for $200,000 on all its franchises and properties and to issue thereunder a like amount of bonds for the purpose of paying for the water-power of the Mooney horse-nail mill property at Ausable Forks, N. Y. The company now furnishes electric light in the village of Keeseville and the towns of Ausable, Chesterfield and Peru. It purposes to build a new power house and to install necessary machinery for generating a total of 500 hp in order that it may extend its operations to other parts of such towns and to the hamlet of Ausable Forks and the towns of Jay and Black Brook. Part of the proceeds of the bonds now asked for are to take up outstanding obligations of the petitioning company.

The Port Jervis Light & Power Company has been authorized to issue $18,000 of first-mortgage bonds, to sell

the same at not less than 90 and to apply the proceeds from the sale to the reimbursement of its treasury for moneys expended from income in carrying out additions and improvements to its property.

The commission will this week hold a hearing on the complaint of the Board of Trustees of the village of Catskill against the Schoharie Light & Power Company as to the rate charged for street lighting in that village; also, on the application of the Wayne County Gas & Electric Company for permission to exercise franchises in the town of Manchester and the village of Newark, Wayne County, and on the complaint of residents of Coxsackie against the Upper Hudson Electric Company as to regulation of voltage of energy supplied for light, price of electricity and alleged discrimination in rates.

NEW HAMPSHIRE COMMISSION.

The commission has granted permission to the Ashuelot Electric Company to issue $70,000 of common and $70,000 of preferred stock to be used for payment of the Keene Electric Company.

The following regulations have been issued, governing the construction and filing of rates, charges and prices of public utilities, taking effect Nov. 1:

Every public utility subject to the provisions of an act establishing the Public Service Commission shall draw up schedules showing the rates, charges or prices for all varieties of service rendered by it. The schedules shall contain a full and complete list of all the kinds and classes of service rendered within the State of New Hampshire, with the rate, charge or price for each unit or item of such service. In any case where any such utility is providing service at other than the regular rate, charge or price, a full list of such exceptions shall be made, setting forth in each instance (1) the name of the person, partnership, association or corporation with which any contract for such service is in force; (2) the rate, charge or price fixed therein; (3) the date when such contract was made and the date when the same shall expire or may be legally terminated by the utility.

In any case where any rate or regulation of any utility provides for a discount from the regular rate, or in any way affects any rate, charge or price for service, such rule or regulation, or the effects of the same, shall also be set forth.

Each schedule of rates, charges and prices and a statement of rules affecting the same and list of exceptions thereto shall be filed with the Public Service Commission at its office in Concord, N. H.

Notice of any change in any rate, charge or price for service shall be filed with the commission at least thirty days before the date upon which the same is to become effective, unless such change shall be permitted to take effect on less notice by consent of the commission, granted upon application therefor.

Compliance with the order as to all available schedules of rates, charges or prices is required not later than Nov. 15, 1911, and full compliance in every instance not later than Jan. 1, 1912.

MARYLAND COMMISSION.

The Public Service Commission gave Attorney Arthur George Brown a hearing last week, arguing for the Chamber of Commerce against the petition of the Chesapeake & Potomac Telephone Company for permission to abrogate its flat-rate telephone contracts with business firms. Mr. Brown made an earnest plea for a system which he said was in accord with statutory policy of the State of Maryland and in actual operation in other cities of the country. At the conclusion of Mr. Brown's argument Mr. Ambler called attention to the fact that the commission did not intend to act hastily in the matter, but that it was inclined to think that there was justice in the plea of the company, because the reports of the experts that they had employed showed that the burden of the flat-rate telephones was borne by the subscribers who had measured service.

Anxious to determine whether or not a satisfactory device for registering telephone calls and adaptable for use in Baltimore city has been placed on the market, the Public Service Commission has sent its chief engineer, Charles E. Phelps, to Albany, N. Y., for the purpose of gathering at first hand information regarding the working of the telechronometer, a recent invention, which is being tested by the Public Service Commission of that State, to register the time during which a telephone connection lasts, somewhat as a watt-hour meter measures energy. The instrument begins to register immediately after the connection between the calling line and the called line is made. Its advocates claim for it the advantage of affording telephone companies a means of charging, and subscribers a means of paying for exactly the amount of service rendered.

MASSACHUSETTS COMMISSION.

Despite a recent positive ruling of the Gas & Electric Light Commission against the granting of franchises by municipal authorities to private parties desiring to transmit electricity across public highways, two new cases of this character have been brought before the board. In one instance Mr. Alfred S. Lowell, of Worcester, seeks authority to transmit electricity from a private generating station across a prominent public thoroughfare to a mercantile establishment owned by the same parties, and in the other case the Gloucester Electric Company appeals to the board against the Oceanside Company, which desires to transmit electricity from an isolated plant in a hotel property to summer cottagers located across the public highway.

Customers of the Electric Light & Power Company, of Abington and Rockland, have petitioned the board for a reduction in the price of electricity. The Foxboro Electric Company has petitioned the board for authority to purchase the Union Electric Light Company, of Franklin, and to issue stock to the amount of $145,300 for that purpose. The Brockton Gas Light Company has petitioned the board for authority to issue new stock to the amount of $250,000 to meet the cost of improvements and extensions, and the Weymouth Electric Light & Power Company has asked the commission to grant a stock increase of $50,000. The Selectmen of Framingham have petitioned for lower rates for gas sold by the local gas company.

WISCONSIN COMMISSION.

The commission has received an application from the village of West Salem for a certificate of convenience and necessity relative to the establishment of a second electric utility, or, as an alternative, an order for the enlargement, rebuilding and re-equipment of the existing utility and the improvement of its service. The existing plant is a privately owned water-power plant located some distance from the village. The petitioner alleges that numerous residences and industrial and manufacturing establishments desire electric service, but have been denied because of inadequate facilities. It is alleged that there is ample water-power available to satisfy all the requirements of the village. The annual report of the plant shows that the ratio of operating expenses to operating revenues is less than 50 per cent and less than that of almost any other plant in the State. The poor service rendered by the defendant has brought it into contact with the commission on previous occasions. The hearing has been set for the December calendar.

The commission has taken testimony in the matter of the investigation, on motion of the commission, of the rules, regulations and practices of the Green Bay Gas & Electric Company. The matter was taken up by the commission largely because of complaints registered by the Minahan

Building Company, a small electric utility in competition with the Green Bay Gas & Electric Company in certain portions of the business district of Green Bay. The substance of the complaint as stated at the hearing was that the Green Bay Gas & Electric Company has repeatedly sought through special offers to induce consumers of the petitioner to take service from the respondent company. It was alleged, and to a certain extent substantiated at the hearing, that these inducements took various forms, such as free lamp renewals, free fixtures, special rates for certain purposes, etc., or in general a departure from published tariffs and practices in the district served by both utilities. The commission has taken the case under advisement.

A suit of considerable importance to the commission and to the water-power owners of the State has been begun in the United States District Court. This suit involves the constitutionality of the water-powers act passed by the last Legislature, and was brought by the St. Croix Falls Improvement Company against the Attorney-General and the Railroad Commission. The complaint sets forth that the defendants maintain that under the new law the water-power is a public use held by the State and subject to the control of the State, and that the law repealed all franchises and permits and all rights under the general statutes or by virtue of riparian ownership under which the Wisconsin branch of the company is owning and operating the dam. According to the complaint, the Attorney-General has declared that unless the Wisconsin company applies to the commission and receives a franchise subject to all terms and conditions of the new law he will bring an action to abate the dam as a public nuisance and bring action to collect a sum of $50 for each day it maintains the dam after Jan. 1, 1912, and the Railroad Commission has declared that unless the company complies with the new law it will receive from any person or corporation properly organized an application for a franchise to construct and operate a dam where the complainant now operates its dam or at any other point where the company now owns land. The plaintiffs pray that the water-powers act may be declared unconstitutional; that the AttorneyGeneral be perpetually enjoined from interfering with the possession of the dam and from bringing actions against them, and that the commission be enjoined from receiving or acting upon applications for franchises to erect a dam on the land of the plaintiffs. The St. Croix Improvement Company is a three-million-dollar corporation, and energy is supplied from its dam on the St. Croix River to the city of Minneapolis and to several villages in the vicinity.

CURRENT NEWS AND NOTES.

Electric Welding.—Among the papers to be presented at a meeting of the American Society of Mechanical Engineers in New York on Nov. 14 will be one on electric welding by Mr. C. B. Auel, of the Westinghouse Electric & Manufacturing Company. There will also be presented a paper on "thermit" welding by Mr. G. E. Pelissier, of the Goldschmidt Thermit Company. A general paper dealing with the apparatus used in the different processes will be read by Mr. H. R. Cobleigh, of the International Steam Pump Company.

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Changing Illuminated Signboard.—The latest novelty among the large electric roof signs along State Street, Chicago, is a new illuminated signboard overlooking the Adams Street corner, in which the changes of expression on the face of the youngster it depicts are accomplished by moving a series of shutters. When first illuminated the sign shows the baby crying for a well-known breakfast food which the sign advertises. The reflector lamps are then extinguished and during this "dark change" a motor reverses the row of shutters, bringing into view, when the lamps are again lighted, the smiling countenance of the youngster, while below in electric letters appears the line explaining "He's got it."

* * *

Meeting of Boston Edison Section, N. E. L. A.—At the October meeting of the Boston Edison Section of the N. E. L. A. the following officers were elected for the ensuing year: President, Mr. D. S. Boyden; vice-presidents, Messrs. C. H. Ingalls and H. W. Stevens; secretary, Mr. W. F. Stevens; treasurer, Mr. S. J. Lent; executive committee, Messrs. C. H. Miles and G. H. Davidson. Following the election of officers papers were read by Messrs. C. A. White and C. H. Crockett on "A General Service Depot," and by Mr. D. S. Boyden on "Steam Heating." The first excursion of the year took place in October, the section visiting the works of the Hood Rubber Company at Watertown, Mass., which were recently equipped with electrical machinery.

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Meetings of the A. S. M. E.—The American Society of Mechanical Engineers will hold two meetings in New Haven on Nov. 15. At the afternoon session the general subject for discussion will be the cost of energy obtained from steam engines, steam turbines, gas and oil engines. At the evening session Prof. C. F. Scott, of the department of electrical engineering of Yale University, will deliver an illustrated lecture on the system and practices of the Hartford Electric Light Company. The A. S. M. E., the A. I. E. E. and the Boston Society of Civil Engineers will hold a joint meeting in Boston on Nov. 15, when a paper entitled "Some Refractory Substitutes for Wood" will be read by Prof. Charles L. Norton, of the department of physics of the Massachusetts Institute of Technology.

* * *

University Lecturer for Central Station Employees.—Announcement has been made of a course of lectures on electrical subjects at the Johns Hopkins University for the employees of the Consolidated Gas, Electric Light & Power Company, of Baltimore. The lectures will be given in connection with the work of the company section of the National Electric Light Association. The work has been outlined by Messrs. Douglass Burnett, R. H. Tillman, R. F. Bonsall and others. A course of ten lectures will be delivered by Dr. John B. Whitehead, professor of applied electricity at the Johns Hopkins University, on alternate Tuesday nights. On the intervening Tuesday evenings members of the company's organization will discuss phases of its work. The section has elected the following officers: President, Mr. R. H. Tillman; vice-president, Mr. A. S. Loiseaux; secretary, Mr. D. C. Bruce; treasurer, Mr. R. F. Bonsall.

* * *

"Centennial" Corliss Engine on Its Way to the Scrap Heap.—Among other steam engines replaced by electric drive in the works of the Pullman Company in Chicago, as related in the *Electrical World* of March 23, 1911, was the famous vertical two-cylinder walking-beam Corliss engine exhibited at the Philadelphia Centennial Exposition of 1876. This engine, rated at 1400 hp, was the most famous stationary steam engine of its time, and it did faithful service at Pullman for more than thirty years, being pointed out to visitors as the great engine that attracted so much attention at the Centennial. It was 39 ft. high and weighed over 800 tons, being larger and heavier than present-day steam turbines of twenty times its rating. The company kept the old engine for some time in the effort to sell it to some person or society that would preserve it for its historical interest, but nobody seemed interested, and finally the ponderous machine was sold to the Oakdale Iron Company for scrap. The engine was dismantled and is now in the purchaser's yards.

TRANSMISSION LINE BETWEEN PEORIA AND PEKIN.—The Peoria Gas & Electric Company is building a transmission line to connect its generating station in Peoria with the generating station of the Citizens' Gas & Electric Company, of Pekin, Ill., which it controls. By means of this line energy may be sent from Peoria to Pekin or *vice versa*, as the exigencies of service demand. The length of the line is about 12 miles.

* * *

FRONTIERS OF SCIENCE.—A course of lectures is to be given at Fullerton Hall, Art Institute, Chicago, this winter by University of Chicago professors on subjects that may be considered to be on the frontier lines of the sciences. Among the subjects announced are "New Proofs of the Kinetic Theory of Matter and the Atomic Theory of Electricity," by Dr. R. A. Millikan, professor of physics (Nov. 16), and "Some Recent Advances in Chemistry, with Special Reference to Radioactivity and the Nature of Matter," by Dr. Herbert N. McCoy, professor of physical chemistry (Nov. 23). The proceeds of the lectures are given to university-settlement work.

* * *

AEROPLANE TRACTIONAL RESISTANCE.—The gliding angle of the average aeroplane is 1 to 6, according to a recent discussion of the subject of tractional resistances in the *Engineer*, London, thus fixing the frictional resistance of the air to the aeroplane's motion at about 370 lb. per ton carried. The frictional resistances for electric and steam-railway loads on level tracks range only from 10 lb. to 30 lb. per ton, while that of steamships may be as low as 1 lb. per ton. The engine-power required to convey a ton on a heavier-than-air machine is thus seen to be about equivalent to that necessary to drag the same load over rough ground without wheels, apparently putting an end to hopes for economic aeroplane transportation where any means of surface conveyance are available.

* * *

SYMPOSIUM ON FUEL ECONOMY.—At a combined meeting of the Society of Chemical Industry and the New York Section of the American Electrochemical Society held during the present week, on Nov. 10, six papers were presented on the general subject of fuel economy. The papers and authors were as follows: *Some Attempts at Economy in Steam Making*, by Mr. J. W. Loveland; *Fuel Gasification for Industrial Purposes*, by Prof. Charles E. Lucke; *A Continuous Carbon Dioxide and Temperature Recorder and Its Application to Combustion Efficiency*, by Mr. Edward A. Uehling; *Is Peat an Important Fuel in America?* by Mr. Charles A. Davis; *Deterioration and Spontaneous Heating of Coal in Storage*, by Messrs. Horace C. Porter and F. K. Ovitz; *The Distribution of Heat in Boiler-Plant Operation*, by Mr. Perry Barker.

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THE ELECTRICAL ENGINEER IN FICTIONAL LITERATURE.—The young electrical engineer and his doings, as conceived by the average writer of fiction, usually make diverting reading for the practical fraternity. The current issue of a weekly story paper of large circulation has a tale which concerns itself with the affairs of a young man who runs "dynamos in the underground power house of a coal mine," adjusts "kilowatts and cut-offs," has $4,000 in the bank and reads Shakespeare and Bacon. The climax of electrical interest in the story, however, seems to come during an altercation in which the hero indulges with his helper in their underground quarters, finally threatening him: "I'll just—oh!—drop you into a magnetic field with fatal results, my good man." Whereat "Saul grinned nervously," while the dynamos—"dangerous mysteries, all too handy to the man they obeyed"—whirred on!

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BOSTON 1912 ELECTRIC SHOW.—Preparations are being continued on a large scale for the electric show which is to be held in Boston in the fall of 1912 under the auspices of the Edison Electric Illuminating Company. As previously stated, the company has leased the entire Mechanics' Building, and 40 per cent of the exhibit space has already been sublet. Four conventions of organizations of prominence have been secured for the exhibition period in Boston, and the general plans of illumination are now well outlined. The company states that the lighting effects will be on a scale surpassing those of any world's exposition thus far held. Elaborate advertising is being carried in foreign and domestic technical journals, and much interest in the plans of the show is being displayed by foreign legations. Messrs. L. D. Gibbs and H. W. Moses, of the Boston Edison organization, attended the recent convention of the Sons of Jove in Denver, Col., on behalf of the show's interests. A worldwide search is being carried on, under the direction of Mr. Moses, for new applications of electricity which may be displayed or illustrated at the show. Headquarters are being maintained at 39 Boylston Street, Boston, Mass.

* * *

A NEW SUIT AGAINST THE CHICAGO GAS COMPANY.—In the controversy between the city of Chicago and the People's Gas Light & Coke Company over the question of rates the city has stolen a march on the company by bringing an unexpected suit in equity as a gas consumer. The city asserts that the present value of the company's property devoted to public use is not in excess of $45,000,000, instead of $70,000,000, as declared by the company. Some of the stocks and bonds issued by the company are said to represent either no consideration or inadequate consideration, owing to the exaggerated value of merged properties. Further, the company is said to be purchasing gas from another company controlled by stockholders of the People's company, the price being excessive. Excessive rentals for properties, exorbitant salaries and the ownership of tracts of land which are not used for the manufacture, sale or distribution of gas are also alleged. The rate for gas in Chicago until recently was 85 cents, but it was temporarily fixed at 80 cents by Judge Gibbons, pending litigation over the city's attempt to secure rates ranging from 75 cents to 68 cents covering a period of five years. The city now brings the new suit as a more direct method of reaching adjudication.

* * *

NIAGARA POWER FOR VILLAGES.—The New York State Public Service Commission, Second District, has given authority to the Livingston-Niagara Power Company, of Caledonia, N. Y., to issue stock to the amount of $85,000 and to execute a mortgage on its property, rights and franchises for a sum not to exceed $600,000, to be secured by thirty-year 6 per cent bonds. The proceeds of the sale of the stock and bonds are to be used for the construction of a main receiving station and approximately 50 miles of transmission line, with the necessary right-of-way; the acquisition and improvement of the Wheatland Power Company's property, and such distribution systems, transformers, meters, tools and equipment as may be required to complete the system for operation. The main receiving station, located at Golah, N. Y., and the southern line, about 21 miles in length, are now being completed and will operate at 11,000 volts. Distribution systems in the villages of Avon, East Avon, Lima, Livonia, South Lima and Honeoye Falls, supplied from the line, are being put in an operating condition, and twenty-four-hour service will be inaugurated. Construction work will be begun immediately on the western line to Scottsville, Garbutt, Mumford and Caledonia. The property of the Wheatland Power Company in Scottsville will be improved and distributing systems will be installed in Garbutt, Mumford and Caledonia at an early date, as there is a demand for energy in that section, which the Wheatland Power Company, owing to its limited output, is now unable to supply.

London Traction Merger.—It is reported that electric railways in London having an aggregate capital of $165,000,000 will be amalgamated in the near future, the arrangements having been agreed upon by all parties interested.

* * *

New Orleans Alive to Panama Canal Benefits.—The New Orleans Railway & Light Company is advertising in Northern newspapers asking manufacturers, investors and power users to locate in New Orleans, equip for electric drive and purchase energy from the advertiser. One interesting argument advanced is "Be prepared to serve the extension of trade through the Panama Canal."

* * *

Balloon Advertising in Germany.—A Berlin balloon company utilizes one of its large dirigible balloons to fly over the city every clear evening. Projectors placed on each side of the car project advertisements on a sheet of white canvas fastened on the envelope of the balloon. These advertisements can easily be read from the ground below. The attention of the people on the streets is attracted by the noise of the engine and by electric lights turned on in the car after each advertisement. This form of publicity is being patronized by many of the important firms of Berlin and of Germany. The cost per night is 100 marks ($23.80), for which sum each advertisement is projected thirty times on each side of the balloon for a period of fifteen seconds.

* * *

St. Louis Section, N. E. L. A.—On Oct. 27, at the opening meeting of the St. Louis Section of the N. E. L. A. for the present season, Mr. S. N. Clarkson, power expert for the Union Electric Light & Power Company, gave a paper entitled "A Trip Through Some European Power Plants." Views were shown from the most interesting of both the steam and hydroelectric generating stations in the northern part of Italy and the adjoining section of Switzerland, and the talk included a detailed description of the 23,000-volt direct-current generating station at St. Maurice. The speaker also recounted some personal experiences on the trip when the plants were visited, and showed a number of slides of general interest from pictures taken in Great Britain and continental Europe.

* * *

Award of Nobel Prizes.—According to reports from Stockholm the Nobel prize for chemistry has been awarded to Mme. Marie Sklodowska Curie. The Nobel prize for physics has been awarded to Prof. Wilhelm Wien, of Würzburg University. Mme. Curie, who was a co-discoverer with her husband, the late Prof. Pierre Curie, of radium, in 1903 shared with him half of the Nobel prize for physics, the other half being awarded to Prof. Antoine Henri Becquerel. Each of the five Nobel prizes awarded annually amounts to $40,000. Recent announcement was made of the success of Mme. Curie in producing polonium, "a new element possessing a radio-activity superior to radium." It was reported on Oct. 18 that the Nobel prize for physics probably would be awarded this year to Mr. Thomas A. Edison.

* * *

"Seeing at a Distance" Bobs Up Again.—A Spokane (Wash.) newspaper dispatch says that Antonio Scarpelli brought suit against Phillipe Vignoli to recover $2,000 alleged to have been advanced by the former on the representation of the defendant that he was developing an invention by which one could see around the world by utilizing the Hertzian waves in a manner analogous to wireless telegraphy. Scarpelli thought it would be a fine thing to have long-distance vision of his friends in Italy and gave Vignoli more than $2,000, he says, to perfect the "invention." Later he became convinced that he was being swindled and he had Vignoli arrested. Seeing at long distance is no new conception, for a Polish schoolmaster with a richly consonanted name attracted much attention a number of years ago by his claims in this direction.

* * *

Meeting of Cleveland Electrical League.—The Electrical League of Cleveland held its first noonday lunch of the season Nov. 3 at the Gillsy Hotel. The attendance of 163 members and guests was very gratifying, and much enthusiasm in the work of the league was shown. President H. H. Cudmore introduced as the principal speaker Mr. Homer E. Niesz, president of the Electrical Club of Chicago. After describing the work and plans of his club Mr. Niesz spoke of Cleveland as the birthplace of the co-operative development movement which was started several years ago. Another step for which Cleveland is largely responsible is the "electrical page" which is appearing weekly in one or two daily newspapers in various cities. Mr. Niesz spoke of the way in which this had been brought to the attention of the Chicago club recently, and said that while no definite action had been taken toward arranging for an electrical page in the Chicago papers, yet the members of his club are very much interested in the matter. Noonday lunches of the Electrical Club of Cleveland will be held on alternate Thursdays from now on, and the plan is to hold a smoker once a month at which unusually interesting entertainment features will be provided.

* * *

Steel-Wire Gage.—The steel-wire manufacturers of the country have been using a number of wire gages differently designated, but all practically identical with the Washburn & Moen gage. Upon the recommendation of the Bureau of Standards at Washington a number of the principal wire manufacturers and important consumers have agreed to designate this gage as the "steel-wire gage"; or, in cases where it becomes necessary to distinguish it from the British standard wire gage, it may be called the United States steel-wire gage. The only wire gage recognized in acts of Congress is the Birmingham gage, which the Treasury Department uses in connection with the importation of wire, and until certain provisions of the tariff act are amended its employment probably cannot be discontinued. This gage, however, is considered by many as radically defective; moreover, it is nearly obsolete, both in the United States and in Great Britain, where it originated. For copper wires and wires of other metals the gage universally recognized in the United States is the "American wire gage," also known as the Brown & Sharpe gage. No confusion need arise between the steel-wire gage and the American wire gage, as the application of either gage is distinct and definite.

* * *

Annual Meeting of Electrical Credit Association of Chicago.—The sixteenth annual meeting of the Electrical Credit Association of Chicago, of which Mr. Frederic P. Vose is secretary, will be held at the Chicago Athletic Association, 12 South Michigan Avenue, on Nov. 16, beginning at 2 p. m. Papers will be presented as follows: *Disputed Accounts and the Executive Committee,* Mr. A. O. Kuehmsted, Gregory Electric Company; *Keeping Faith,* Mr. W. A. Brady, Commercial Electrical Supply Company; *Reporting Municipalities,* Mr. E. E. Ingels, B-R Electric & Telephone Manufacturing Company; *Forms and Model Letters,* F. D. Van Winkle, Post-Glover Electric Company; *Does the Association Pay?* S. E. Kennedy, Central Electric Company; *Contractors as Credit Risks,* E. R. Gilmore, Western Electric Company; *The Credit and Sales Departments,* George C. Steele, North Electric Company. A lively discussion is anticipated. The annual dinner will be served at 6:30 p. m. at the same place. Mr. A. A. Gray will act as toastmaster and Mr. H. H. Cudmore will lead the singing. Mr. Kuehmsted is chairman of the entertainment committee, and Mr. Henry Schwab, of the Monarch Electric & Wire Company, is chairman of the committee which will nominate officers for the ensuing year.

MODERN TURBINE PLANT AT INDIANAPOLIS.

The Mill Street Station of the Indianapolis Light & Heat Company Using Superheated Steam, Water-Borne Step-Bearings for Vertical Turbines, Etc.—Condenser Intake Dam Construction Shared by Park Board.

THE Mill Street station of the Indianapolis Light & Heat Company furnishes electrical service for the company's customers in Indianapolis and in Woodruff Place, the city's famous "corporation within a corporation," and also transmits energy within a radius of 10 miles to the neighboring towns of Broad Ripple, Lawrence, Fort Benjamin Harrison, Cumberland, Beach Grove, Southport and Michigan Hill. This modern turbine plant has now become the principal generating center of the Indianapolis company, the older Kentucky Avenue station, with its reciprocating sets, being reserved for steam-heating service during the winter months, when its electrical output is limited to the equivalent of the demand for exhaust steam.

Although the Mill Street station was planned for turbine operation and its first equipment installed nearly seven years ago while turbines were yet a novelty in steam engineering, the foresight displayed in the design of the plant has made it adequate for all such extensions as have since been necessary. In its layout, as shown in an accompanying sketch, the station follows the plan of having a transverse boiler-room supplying steam for a group of turbines, a scheme the most notable exemplification of which is probably the Fisk Street station of the Commonwealth Edison Company, Chicago. The Mill Street plant is designed for a duplication of its present dimensions, the turbine-room to be extended further northwest by its present length, while a duplicate of the present boiler-room will be added parallel to the existing one.

COAL-HANDLING AND BOILER-ROOM ARRANGEMENT.

The plant is located on Mill Street, near Eighteenth Street, and is on a spur of the Cleveland, Cincinnati, Chicago & St. Louis Railroad, over which coal, supplies and machinery can be delivered directly to the station. Extending 25 ft. behind the boiler-room is the roofed coal-track space over the track hoppers leading to the coal crushers. For spotting the drop-bottom cars a motor-driven winch is provided at one side of the track. This winch, which has a belt-driven winding drum, is operated by a 10-hp induction motor installed inside the building walls, but controlled from a hand starter outside. Both steam-driven and electrically operated crushers are provided, the coal discharged from these machines being thence deposited in a McDonald bucket conveyor and by it elevated 60 ft. into the 1000-ton coal bunkers over the boiler-room. These bunkers are of steel and concrete and are carried on the steel framing of the boiler-room.

The steam generating equipment comprises four 612-hp and four 729-hp Stirling boilers, all equipped with Roney

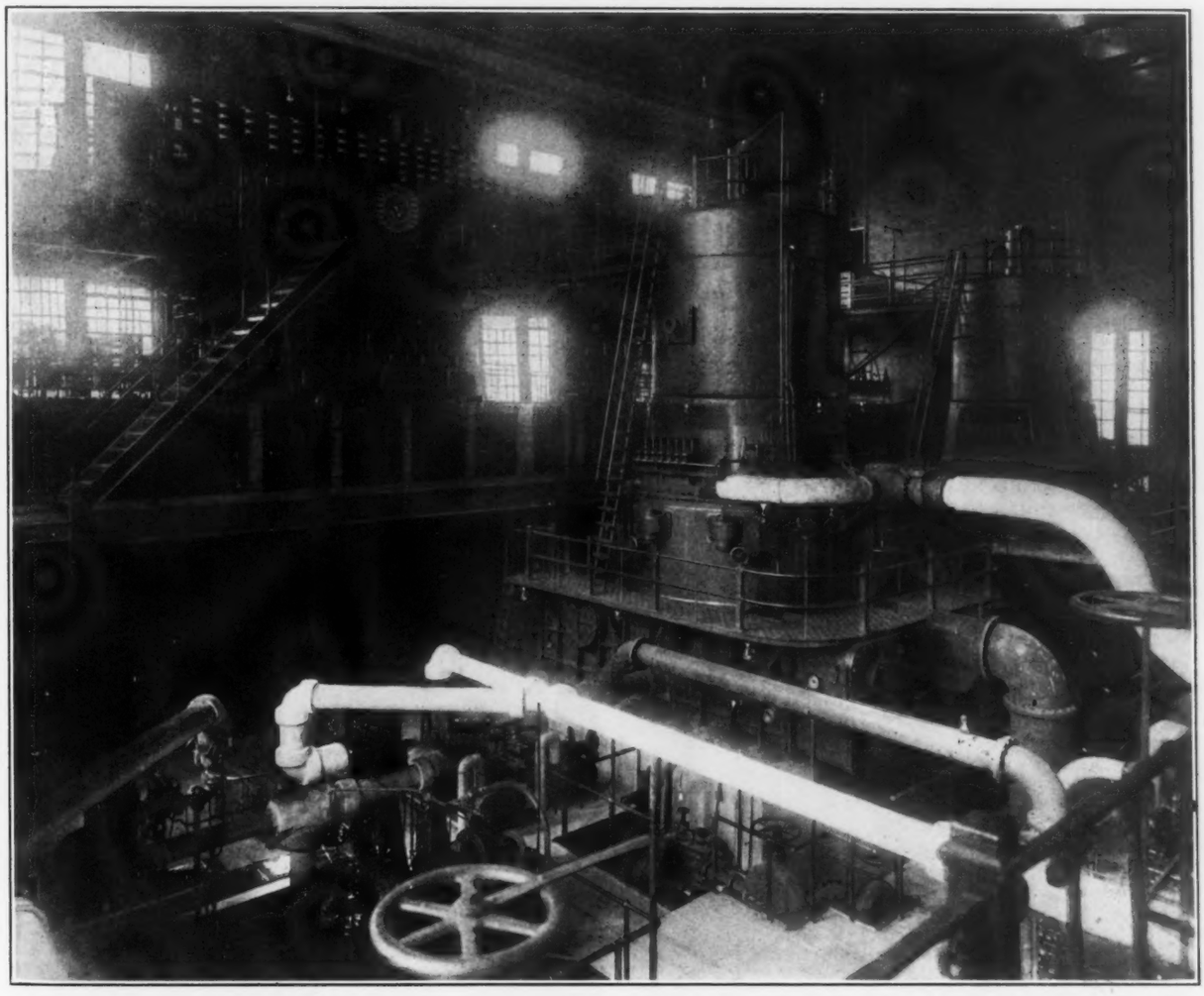


Fig. 1—Interior of Turbine-Room, Showing Large Vertical Units and Switching Apparatus.

automatic stokers. These boilers produce steam at 160 lb. per square inch pressure and 125 deg. Fahr super-temperature, being provided with self-contained superheaters, thus permitting only superheated steam to be withdrawn from them.

The flue gases from the row of smaller boilers are carried aloft through a 210-ft. brick chimney, 10 ft. in internal diameter. The four 729-hp units are served by a 16-ft. brick stack, 210 ft. above the grates and carried on a concrete-and-pile footing 38 ft. square. This large stack will also serve one-half of the future boiler-room, paralleling the present one. Space is provided at the base of the chimneys for feed-water heaters, which may be installed later.

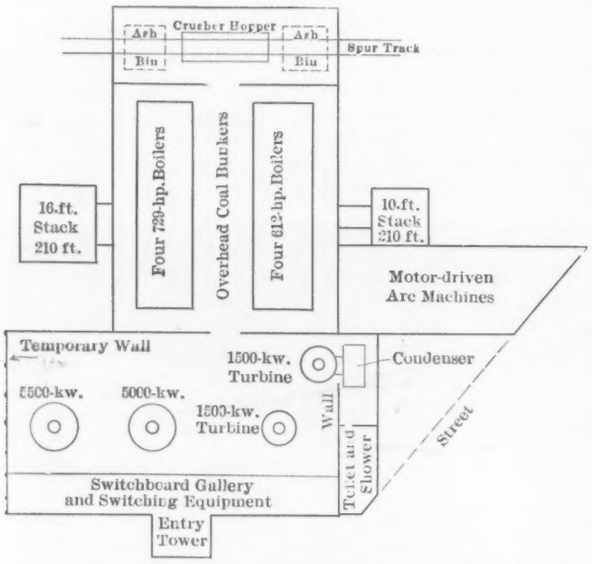


Fig. 2—Arrangement of Mill Street Station, of Indianapolis.

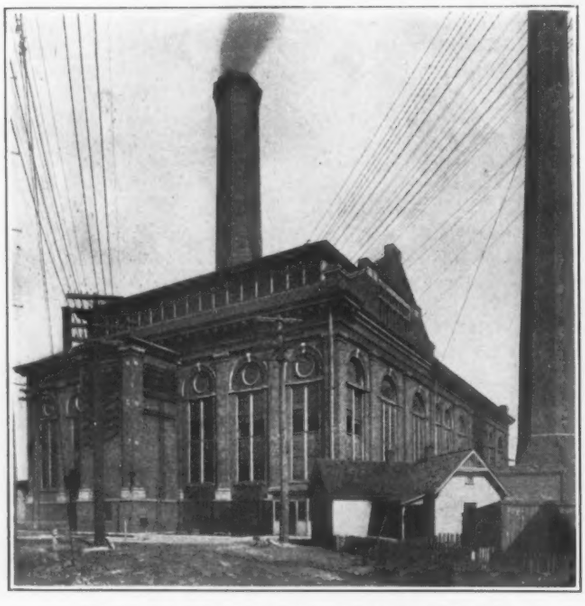


Fig. 3—Feeder-Line Entries of Mill Street Station.

Ashes from the grates are dumped through the basement into the same bucket conveyor used for handling the coal, which elevates them to the two 15-ft. by 15-ft. by 20-ft. concrete ash bunkers over the coal-car space outside. From these the ashes can be dumped directly into the empty railroad cars beneath or loaded through a chute on to wagons.

In addition to the 1000-ton coal supply in its overhead bunkers the Indianapolis company maintains about 10,000 tons in open storage in its yard adjoining the Mill Street station, and an equivalent amount at its Kentucky Avenue plant, so that it is well guarded against strike flurries. According to local experience such open storage is more conservative of the heat units in the coal than storage under cover in sheds, where the coal slacks and dries, breaking up almost into dust.

TURBINE GENERATING EQUIPMENT.

The turbine-room, which adjoins the 84-ft. by 76-ft. boiler-room, measures 113 ft. by 62 ft. in plan. The building is of brick, with steel-truss-supported roof, the northwest wall being a temporary one of sheeting, awaiting the extension of the plant, as already outlined.

The first machines installed at Mill Street were two 1500-kw, 4100-volt, 60-cycle, three-phase Curtis turbo-generator sets, put in operation in 1905. In 1909 a 5000-kw turbine of similar type was added, and during the present year one of the smaller turbines was replaced by a 5500-kw unit.

When the second of the original small turbines was removed to make room for the larger set the local engineers were confronted with the problem of either discarding it entirely or finding room for it in the station, where it might be called upon in case of emergency. As practically all the available space in the building was occupied by the existing units and their auxiliary machinery, the rather extraordinary setting illustrated in Fig. 4 was determined upon, the condenser being placed in a brick addition built on to the main plant. As now placed the center of this

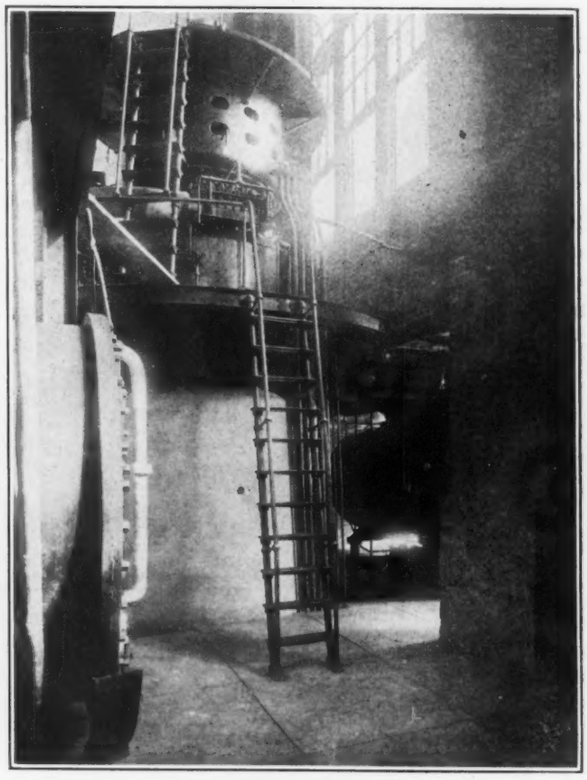


Fig. 4—Unique Setting of Reserve 1500-kw Turbine Unit and Condenser.

reconstructed 2250-kw turbine set is only 6 ft. from the south wall and 10 ft. from the east wall. The original position of the condenser with respect to the turbine would thus have brought it in line with the heavy brick wall of the building, rendering access to the tubes impossible. An intermediate 4-ft. length of vacuum line was therefore

added, as shown, and the condenser was accordingly brought clear of the wall and into the adjoining space, which also contains its auxiliary apparatus, pumps, etc. As already explained, this turbine is now reserved merely for auxiliary duty, and its unique setting was made only to save the total discard of the unit.

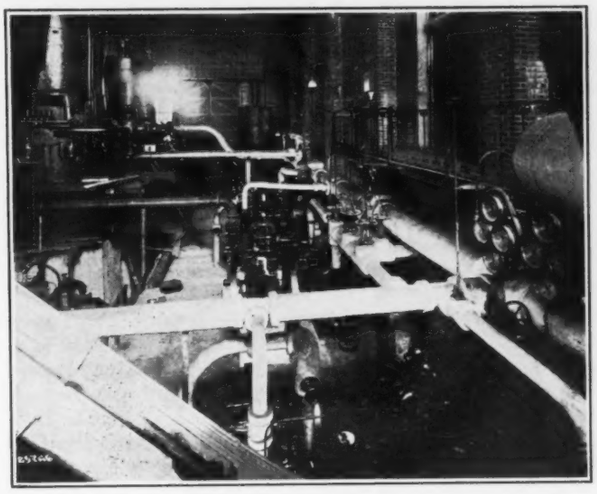


Fig. 5—Steam Header and Auxiliary Piping Installed in Turbine-Room.

The two large turbines have base-type Worthington surface condensers, while those of the smaller unit are placed alongside its concrete base. The two earlier turbines and the latest large one are equipped with water step-bearings, and it is now planned to convert the oil bearing of the earlier large unit to the water type. As at present installed two accumulators are provided, one for the oil and one for the water-bearing lines, the pressures of which, practically identical, approximate 1250 lb. per square inch. Baffles in the bearings reduce this pressure to about 800 lb. at the steps. The water bearings have the advantage, of course, of an easy and assured supply of lubricant, and

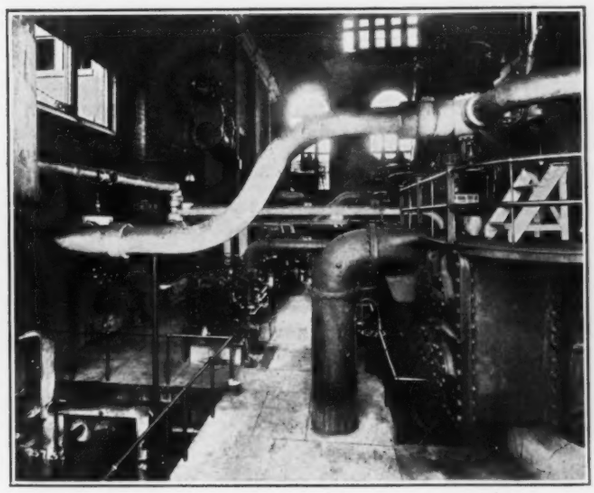


Fig. 6—High-Pressure Steam Headers and Auxiliaries in Turbine-Room.

have been found quite as satisfactory in all other respects as the oil bearings in use at Mill Street. Distilled water from the condensate of the turbines is used in the bearings. As a precaution that a good supply shall always be on hand standpipes are connected to the lines from the hot-wells, so that these pipes are continually kept full, and from them the bearing pumps take their supply. The make-up water required to be added to the condensate from the turbines is obtained from the city mains.

CONDUITS, PIPING, ETC.

Condensing water for the turbines is taken from Fall Creek, a small stream a quarter of a mile distant. This

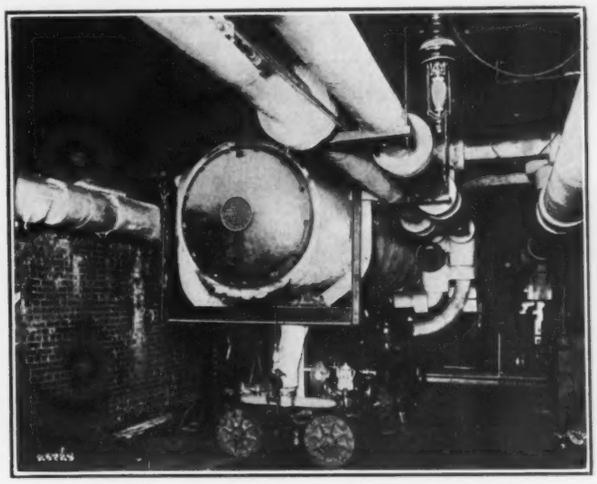


Fig. 7—Exhaust Feed-Water Heater and Pumps in Basement of Boiler-Room.

creek is bordered by a park and boulevard, and through an arrangement with the park board a 4-ft. masonry dam, 200 ft. wide, was built jointly at the expense of the city and the company. This dam adds greatly to the natural beauty of the park and also provides an ample pond for the plant intake line. The 4-ft. intake conduit slopes from the bank toward the wells beneath the turbines, from which the engine-driven pumps lift it through the condensers and back into the 4-ft. discharge pipe returning to the creek. Just before entering the plant the intake line broadens into a circular concrete strainer well, the water flowing through screens which free it of floating and entrained material. At the engine-room floor float gages, constructed of vertical slotted ¾-in. pipes, show the levels of the water in the wells beneath each turbine.

The boiler steam lines are provided with safety non-

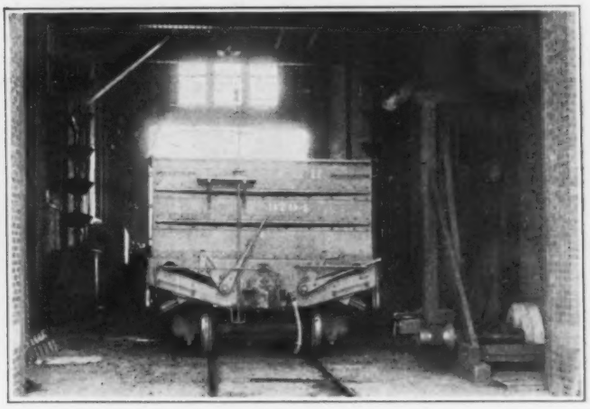


Fig. 8—Coal and Ash-Handling Apparatus, Motor-Driven Car Spotter, Etc.

return valves, preventing back-flow of steam from the headers or other boilers in case of failure of one unit. Each row of boilers has its own header which joins the main transverse header in the turbine-room. By the arrangement of valves and by-pass lines used, steam can be supplied from either row of boilers to any group of

machines while other parts of the main and supplementary headers are undergoing repairs. The original fittings installed at Mill Street were of ferro-steel with screwed flanges, but these are now almost entirely replaced by cast steel with Crane lap joints.

All of the condenser auxiliary equipment is steam-driven. The excitation apparatus includes a 100-kw Curtis turbine-driven direct-current generator, running at 2400 r.p.m.; a marine-type, engine-driven exciter, and one 150-hp and one 85-hp, 4000-volt induction motor-generator set.

SWITCHING APPARATUS.

All switching and control equipment of the station is located on overhead galleries overlooking the turbine-room floor. On the first gallery are the oil switches and bus compartments mounted in brick cells. The upper story carries the main switchboard and also the induction-type feeder regulators for controlling the pressure of the long lighting feeders which radiate from the station. The switchboard is equipped with curve-drawing voltmeters, Tirrill regulators, etc. Motor-operated rheostats, with setting indicators, are provided for the large turbine field circuits.

On the gallery railing in front of the switchboard is a hand-operated load indicator which can be seen from any part of the turbine-room and from the boiler-room entrance. On this indicator from time to time the switchboard attendant observes the total load on the station as a guide to the turbine operators and firemen. A supplementary dial shows the time at half-hour intervals. The turbine-room is spanned by a 50-ton, three-motor Shaw crane, capable of handling any piece of machinery on the floor beneath.

In the downtown district of Indianapolis the Indianapolis Light & Heat Company maintains a 110-220-volt Edison three-wire circuit within the "mile square" bounded by North, East, South and West Streets. The company's direct-current substations, each containing a 1000-kw motor-generator set, are located, one at the Kentucky Avenue plant, one in the rear of the company's business offices at 48 Monument Place and the third on Wabash Street, near East. On Bird Street, just north of Ohio, a large storage battery is continuously maintained in service, "floating" on the Edison system. In addition to its motor-generator equipment, 3000 kw of engine-driven direct-current machinery is reserved at the Kentucky Avenue plant for auxiliary duty and for non-condensing operation in connection with the steam-heating service during the winter months.

Mr. C. C. Perry is president and general manager of the Indianapolis Light & Heat Company, Mr. T. A. Wynne is general superintendent, Mr. R. M. Cass is electrical engineer and Mr. E. Mettler is engineer of the Mill Street station.

SAGS AND TENSIONS OF OVERHEAD CONDUCTORS.

Graphical Method for Determining the Mechanical Constants of Transmission Lines.

By Alfred Still.

THE formula in general use for determining the relation between sag and tension in conductors of overhead transmission lines is:

$$T = l^2 W \div 8 s \qquad (1)$$

where l and s are respectively the length of span and sag of the wire at the center of the span, both expressed in feet; W is the uniform weight of the conductor in pounds per foot of length and T is the tension in pounds in the conductor at the lowest point of the catenary. This formula is based on the fact that the catenary approximates to the parabola when s is small relatively to l, and the assumption that the curve formed by the conductors of an overhead transmission is parabolic introduces no appreciable error in the calculations. In the case of very long spans necessitating a maximum sag which may amount to over 10 per cent of the distance between supports, the less simple formula for the true catenary should be used if great accuracy is required. It may be noted that, although formula (1) gives the tension in the conductor at the center of the span, it is usual to consider this also as the tension at or near the supporting points, and unless the sag is very great relatively to the span the error is negligible. By transposing formula (1) there is obtained,

$$s = l^2 W \div 8 T \qquad (2)$$

from which the sag can be readily calculated for any assumed or known value of the tension T.

In order to calculate the safe minimum sag allowable under the most severe weather conditions, the weight W per foot run will be not merely that of the conductor itself, but the resultant load per foot due to the combined effect of wind and sleet or ice added to the weight of the conductor.

If w = weight in pounds per foot length of the unloaded conductor, then $W = n \times w$, where n is a multiplier to take into consideration the extra weight of the wire under the most severe weather conditions likely to be encountered in the district where the transmission line is located.

It is usual to assume that the wind pressure acts in a horizontal direction and that the total load on a conductor is the resultant of two forces, one acting vertically downward and due to weight of wire together with added weight of sleet or ice, if any, and one acting horizontally due to the wind pressure. These forces are indicated in Fig. 1,

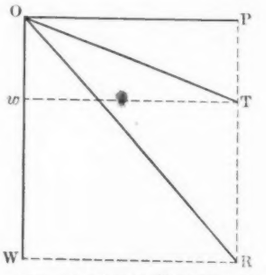


Fig. 1—Force Diagram.

where OP represents the wind pressure, Ow the weight of the conductor and wW the added weight of ice. The resultant pressure OR is equal to $\sqrt{P^2 + W^2}$. If the line runs through a country where sleet does not form on the wires the maximum resultant pressure is OT instead of OR if the assumed maximum force due to wind is the same in both cases.

In Fig. 2 there are shown values of the multiplier n (the ratio $OT \div Ow$) corresponding to various wind velocities for the standard sizes of aluminum conductors on the assumption that there can be no ice formation on the wires, while Fig. 3 gives values of n (ratio $OR \div Ow$) for similar conductors when the weight is increased by a coating of ice 0.5 in. thick with a correspondingly greater wind effect due to the increased diameter.

The formula used for the calculation of wind pressure for use in drawing the diagrams is

$$P = dV^2 \div 4820 \qquad (3)$$

where d is the diameter in inches of the conductor or of the ice coating, as the case may be; V is the actual wind velocity in miles per hour[1] and P is the wind pressure in pounds per foot length of conductor.

Similar diagrams can be drawn giving the value of the multiplier n for copper conductors, but those here published apply only to aluminum. When using the diagrams it

[1] A table giving true wind velocities corresponding to the Weather Bureau observed velocities will be found in Mr. F. F. Fowle's article on sleet loads and wind velocities, on page 995 of the *Electrical World*, Oct. 27, 1910.

should be noted that the distances plotted horizontally represent the squares of the wind velocities and the sizes of the conductors are expressed in equivalent B. & S. wire-gage numbers and circ. mils for the larger sizes.

If the effects of wind and ice can be disregarded, the weight W in formula (1) is merely that of the conductor itself and, for a given material, it will be proportional to the area of cross-section of the wire. If T_a stands for the tension in the wire in pounds per square inch of cross-section, the formula giving the relation between the tension and sag may be written:

$$T_a = knl^2 \div s \qquad (4)$$

where k is a constant which depends upon the material of the conductor, but not upon the diameter, and n is the above-mentioned multiplier depending upon the loading of the conductor.

For copper $k = 0.486$ and T_a should not exceed 28,000.
For aluminum $k = 0.147$ and T_a should not exceed 13,000.
For iron $k = 0.427$ and T_a should not exceed 25,000.

The length of wire between supports of equal height

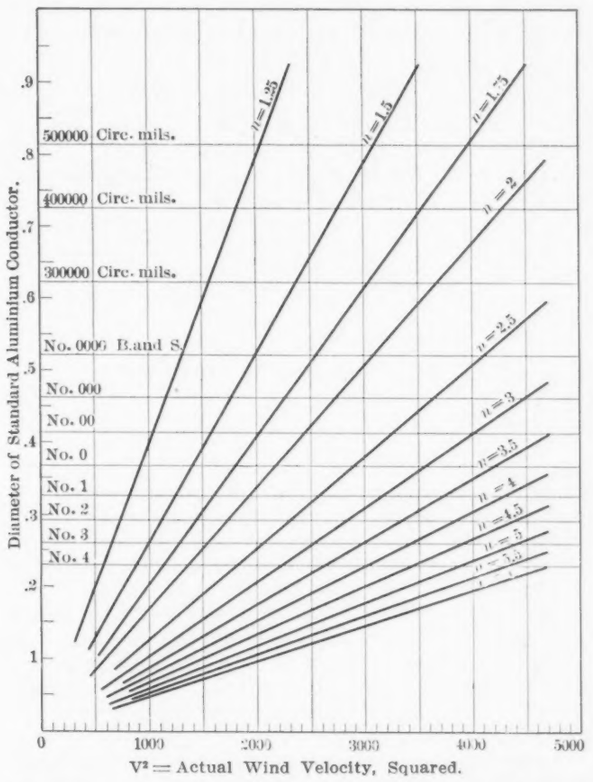


Fig. 2—Curves Showing Values of n Corresponding to Various Wind Velocities for Standard Sizes of Aluminum Conductors.

bears a definite relation to the span and sag, and it is expressed by the formula

$$L = l + (8s^2 \div 3l) \qquad (5)$$

where l is the distance between supports and s the sag at the center, both being expressed in feet, as before.

The increase of length due to stress will be directly proportional to the tension T_a, provided the elastic limit of the material is not exceeded, and this condition will be satisfied if the maximum values of T_a do not exceed the proposed limits as previously given.

The formula for elastic stretching is:

$$L_e = T_a \times L \div M \qquad (6)$$

where L is the length of the wire when $T_a = 0$, L_e is the elongation due to the stress T_a, and M is the elastic modulus.

Values of M, as given by Mr. F. O. Blackwell, are as follows:

Hard-drawn copper wire	16,000,000
Hard-drawn copper cable	12,000,000
Hard-drawn aluminum wire	10,000,000
Hard-drawn aluminum cable	7,500,000
Galvanized-iron or steel cable	22,000,000

The increase of length due to temperature rise, provided the stress does not alter, is:

$$L_t = L \times a \times t \qquad (7)$$

where a is the temperature-elongation coefficient.

If t is expressed in degrees Fahrenheit the values of a are approximately:

For copper $a = 0.0000096$
For aluminum $a = 0.0000128$
For iron $a = 0.0000065$

The purpose of the diagrams to be described hereafter is to simplify and expedite the calculation of sags and tensions required for the guidance of the men actually engaged on the erection of the line. It is a simple matter to

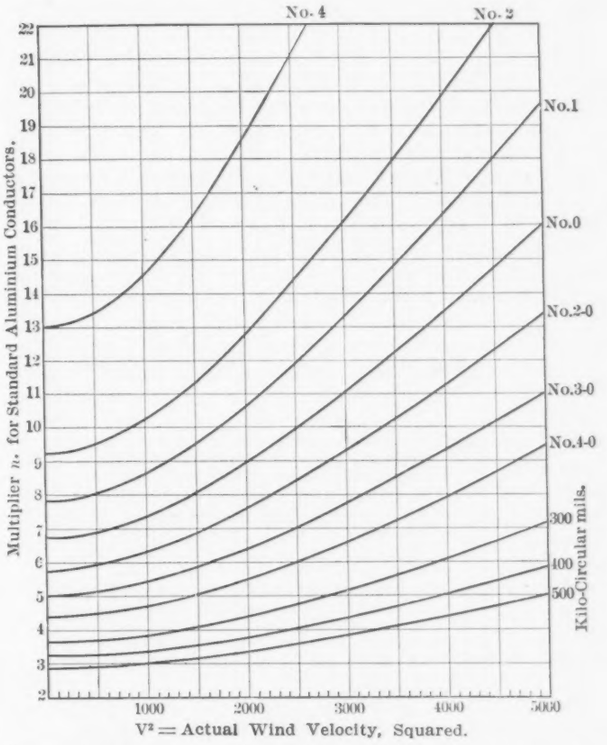


Fig. 3—Values of n for Similar Conductors with a Coating of Ice 0.5 In. Thick.

calculate by means of formula (2) or the modified formula (4) the sag corresponding to any span (l), load (W) and tension (T), and by using either of these formulas the minimum allowable sag for the safe limiting tension T_a when the wire is subject to the greatest expected load in the matter of ice and wind pressure should be determined in the first instance. Having determined the amount of this sag—which should be that corresponding to the lowest expected temperature—the length of the wire in the span can be readily calculated by means of formula (5).

The calculation of the sags and corresponding tensions at other temperatures and under other conditions of loading is not by any means so simple a matter, because the alteration in the length of the conductor depends not only upon the temperature, but also on the tension. If the extra load on the conductor due to wind pressure and ice

(if any) be removed, the sag will adjust itself until the formula (2) is again satisfied, the weight W being in this case that of the wire only. A further condition is that the length of wire shall be equal to the length as originally calculated for the loaded wire, less the elastic contraction due to the reduction in the tension. If the temperature be now supposed to rise, the length of the wire will increase, but not in direct proportion to the temperature rise as indicated by formula (7) because so soon as there is any increase in length leading to an increased sag the tension in the wire is immediately relieved, and since it is assumed that the elastic limit has not been exceeded there will be a reduction in length which could be calculated by formula (6) *if the amount by which the tension is relieved were known.*

A mathematical formula which expresses the required length or sag under normal conditions, in terms of the length corresponding to minimum temperature and heaviest loading, is very complex and difficult of solution. Mr. H. J. Glaubitz[2] has evolved an equation in which the first and third power of the unknown quantity (the deflection or sag) appear simultaneously. The solution of such an equation is tedious and is usually accomplished with the assistance of more or less scientific guesswork. The graphical method, which is probably in more general use, consists in plotting two curves, one showing the relation between sag and tension for the selected span when the wire hangs naturally under its own weight only, and another curve calculated for a definite constant temperature and giving the relation between sag and tension when a wire of definite known length under a known tension is subjected to various assumed changes in the tension. The point where the two curves cross will indicate the required conditions of sag and tension. This process is a lengthy and laborious one and has to be repeated for every assumed change of temperature.

The principles on which the writer's method is based are, briefly, these: Assuming the span to be known and constant, there is then a definite relation between length of wire and sag, as expressed by formula (5), and a definite relation between tension and sag when a wire of known material hangs in still air under its own weight only. This last relation is given by formula (4) when the multiplier n is unity. In accordance with the above, if there be drawn correctly to scale two curves, the one (A) (on transparent paper) giving the relation between length of wire and sag and the other (B) giving the relation between tension and sag, and if the first be placed over the second so that the division corresponding to the known tension shall coincide with the division corresponding to the length of wire as calculated for that particular tension, then the length corresponding to any other value of the tension, if the temperature remains unaltered, can be read at a glance, and the particular length (and corresponding tension), together with the corresponding sag when the wire hangs naturally in still air, is directly indicated by the position of the point where the curve A crosses the curve B. In order to obtain this

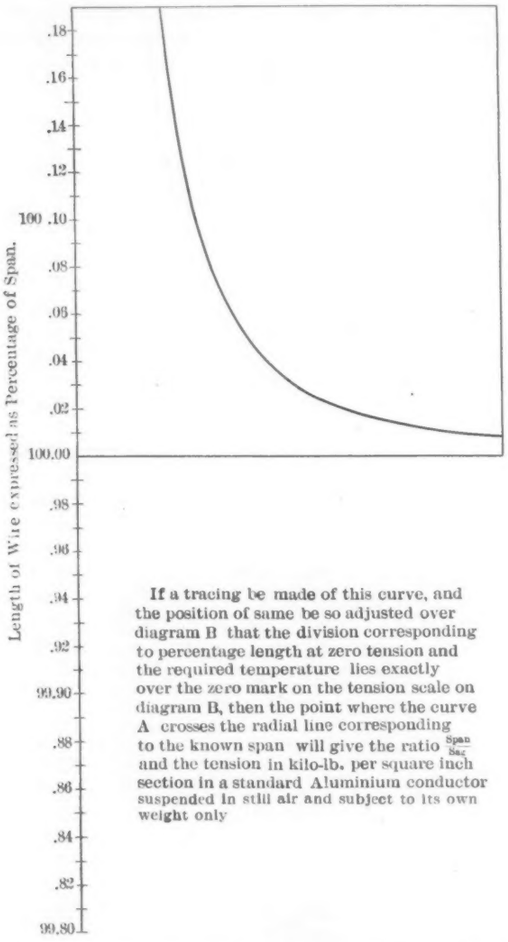

Length of Wire expressed as Percentage of Span.
.18
.16
.14
.12
100 .10
.08
.06
.04
.02
100.00
.98
.96
.94
.92
99.90
.88
.86
.84
.82
99.80
If a tracing be made of this curve, and the position of same be so adjusted over diagram B that the division corresponding to percentage length at zero tension and the required temperature lies exactly over the zero mark on the tension scale on diagram B, then the point where the curve A crosses the radial line corresponding to the known span will give the ratio Span/Sag and the tension in kilo-lb. per square inch section in a standard Aluminium conductor suspended in still air and subject to its own weight only

Fig. 4—Diagram Showing Relation Between Length of Wire and Ratio $m = \frac{\text{Span}}{\text{Sag}}$.

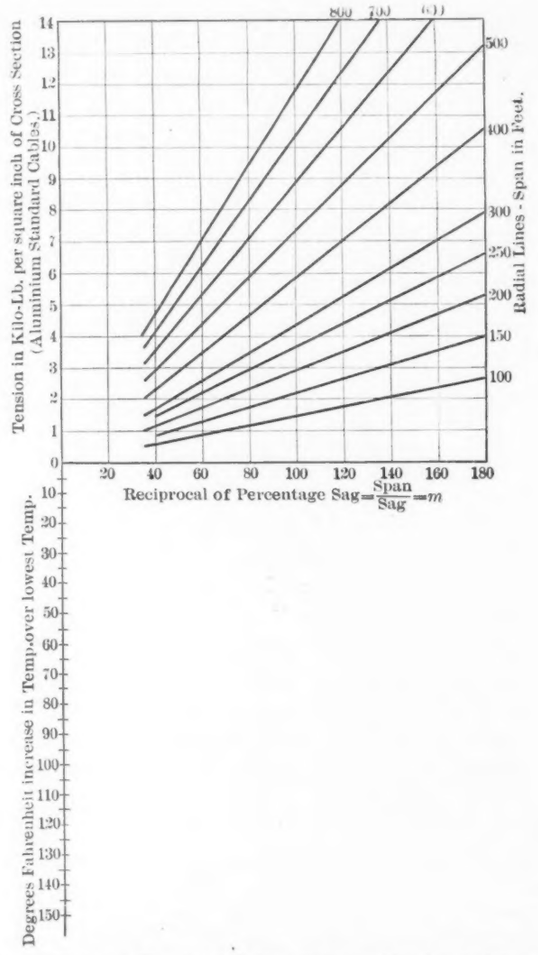


Fig. 5—Diagram Showing Relation Between Tension in Wire and Ratio $m = \frac{\text{Span}}{\text{Sag}}$.

[2] *Electrical World*, March 25, 1909, page 731.

information for any temperature higher than the assumed minimum, a scale of temperature can be drawn on diagram *B*, the divisions being so spaced as to agree with the correct increase of length due to temperature rise when this scale is placed under the scale for length of wire of diagram *A*. This will enable the position of diagram *A* to be shifted so that the length corresponding to zero value of the tension, instead of being the length at minimum temperature, will be the length which the wire would have at the higher temperature if all stress were removed, and the point where the two curves cross will, therefore, indicate the required particulars in regard to sag and tension at the increased temperature.

If curves were plotted from formula (2) giving the relation between tension and sag, each curve would be a rectangular hyperbola, and, for different spans, T would be proportional to l^2. This would make the drawing of a number of curves very tedious; but by plotting the tension T and the value $l \div s$ there is obtained a "straight-line" relation between the two quantities, and since, for different values of the span l, the tension T for a given value of $l \div s$ will be directly proportional to l, the drawing of a number of radiating straight lines giving the relation between T and $l \div s$ for various values of l becomes a very simple matter.

METHOD OF DRAWING THE DIAGRAMS.

The diagram *A*, Fig. 4, gives the relation between the length of wire, expressed as a percentage of the span l, and the ratio of $m = l \div s$. This relation is independent of the material of the wire and of the load, provided the load is uniformly distributed. It is derived from the formula (5).

Let L_o = percentage amount by which length of conductor differs from length of span, then

$$L_o = \frac{8 s^2}{3 l} \times \frac{100}{l}$$

and putting m for the value $l \div s$ we get

$$L_o = 800 \div 3 m^2 \qquad (8)$$

by means of which the curve *A* can readily be plotted with m measured horizontally and L_o or $100 + L_o$ vertically. The vertical scale indicating the length should include values of L less than the span l because the length of wire if all tension is supposed to be removed will frequently be less than the length of span. This curve (*A*) should actually be drawn on transparent paper so that it can be placed over the second diagram.

In plotting diagram *B*, Fig. 5, the horizontal divisions representing the ratio m must obviously correspond exactly with the scale adopted for diagram *A*.

To divide correctly the vertical scale representing tension in pounds per square inch of cross-section use is made of formula (6) for determining the increase in length due to elastic stretching, but the percentage increase is $100\, T_a \div M$ and the scale of the tension T_a will depend upon the elastic modulus M, and, therefore, on the material. For stranded aluminum conductors a stress of 3000 lb. per square inch will produce an elongation of approximately 0.04 per cent.

In order to plot the curves for various spans (all of which are straight lines radiating from a common center) use is made of the relation $T_a = kl^2 \div s$, which is the original formula (4), where $n = 1$, and if m be substituted for $l \div s$ there is obtained

$$T_a = m \times k \times l \qquad (9)$$

In regard to the scale for temperature rise, which may conveniently form a continuation of the tension scale below the datum line, use can be made of formula (7), but the percentage increase is $100 \times a \times t$, and the scale for temperature rise will depend upon the coefficient of expansion a and, therefore, on the material. For aluminum a rise of temperature of 55 deg. Fahr. will produce an increase in length of approximately 0.07 per cent.

METHOD OF USING THE DIAGRAMS.

The use of the diagrams is best illustrated by an example. Let particulars of line be as follows:

Span = 200 ft.

Conductors, No. 3-0 B. & S. gage stranded aluminum.

Lowest expected winter temperature = — 20 deg. Fahr.

Ice coating, 0.5 in. thick.

Limiting safe stress, $T_a = 13{,}000$.

Maximum wind velocity = 60 miles per hour (which may occur simultaneously with the maximum ice load).

It is required to determine the sag and tension at a temperature of 60 deg. Fahr. when no wind is blowing and the conductor is subject to its own weight only.

From the diagram, Fig. 3, it is found that the multiplier n for $V^2 = 3600$ is 8.7, and by transposing formula (4) there is obtained

$$m = l \div s = T_a \div (k \times n \times l) = \frac{13{,}000}{0.147 \times 8.7 \times 200} = 50.8$$

which corresponds to a length of 100.104 per cent as read off curve (*A*) or calculated by formula (5). Place 100.104 of the (transparent) diagram *A* over the mark corresponding to a tension of 13,000 kilo-lb. on diagram *B* and under the zero point of the tension scale will be found the length 99.93, which is the length (expressed as percentage of span) which the conductor would have at the lowest temperature if all tension were removed. At a temperature of 60 deg. Fahr. the rise of temperature over lowest winter temperature is $60 + 20 = 80$ deg. Place the division for length 99.93 over the mark for temperature 80 and the point on the length scale of diagram *A* which lies on the datum line of diagram *B* indicates the length which the wire would have at 80 deg. Fahr. if there were no mechanical stress. (In this example the length would be 100.032.) Observe now where the curve on diagram *A* crosses the span line marked 200 on diagram *B* and read off the value $m = 68$ (nearly), giving sag $= 200 \div 68 = 2.94$ ft. and $T_a = 2000$, giving $T = 2000 \times 0.1318 = 263.6$ lb., where 0.1318 is the cross-sectional area of a No. 3-0 conductor. This tension of 263.6 lb. is approximately the pull which should be indicated on a dynamometer if the conductors are being strung at a temperature of 60 deg. Fahr. and there is no wind blowing. If there is only a slight wind blowing at the time of erection the increased tension required is negligible; if the wind amounts to what in nautical terms would be described as a "strong breeze" (34 miles per hour), the multiplier n as read off diagram Fig. 2 is only 1.25 for a No. 3-0 aluminium cable. If, however, the stringing of the conductors were to be carried on in so strong a wind blowing across the length of the line the required tension and sag could easily be read off the diagrams without moving their relative positions. It is merely necessary to read the tension and sag values corresponding to an assumed span of $200 \times 1.25 = 250$ ft. instead of the actual span of 200 ft. The results for the same temperature rise (80 deg.) with an estimated wind velocity of 34 miles per hour would be $m = 65$, giving a sag $= 200 \div 65 = 3.08$ ft., and $T_a = 2400$, making the required pull on a dynamometer $T = 2400 \times 0.1318 = 316$ lb.

The reason for this method of correcting for wind pressure or load on wires will be clear when it is remembered that the law connecting tension T_a and ratio m is no longer

$$T_a = m \times k \times l$$

but

$$T_a = m \times k \times l \times n$$

and the effect of multiplying T_a by n is obtained by assuming a value for l which is n times as large as the actual span.

THE PRODUCTION AND UTILIZATION OF OZONE IN EUROPE.

Description of Various Kinds of Ozonizing Apparatus—Use of Ozone for Purification of Water and Air—Cost of Ventilation and Air Purification.

By John B. C. Kershaw.

OZONE is an allotropic modification of oxygen and possesses the chemical properties of the latter in a peculiarly active form, due to the fact that in the ozone molecule three atoms of oxygen are present in the space that usually holds two.

Ozone can be produced in various ways: (1) By the action of phosphorus upon moist air; (2) by the action of strong sulphuric acid upon potassium permanganate; (3) by the electrolysis of water, and (4) by the discharge of high-potential electricity through dry air. For practical purposes the last-named method is the only one employed for the production of ozone. Within the last ten years considerable improvements have been made in design of ozonizing apparatus and in the methods of application of this gas to numerous purposes. Removal of the dust and moisture from the air and of the suspended or chemical impurities from the water is an essential preliminary to the successful use of ozone.

The various types of machines now made for the production of ozone by the silent electric discharge are in many cases improved forms of the first type of apparatus constructed by Werner von Siemens in the year 1875. This Siemens ozonizer consisted of two concentric glass tubes, one slightly larger than the other, coated with tinfoil on the external and internal faces respectively. The two coatings were connected with the two poles of a high-potential electrical machine, and a current of dry air was passed along the annular space between the two glass tubes. Under these conditions ozone was produced, the amount being dependent upon rapid withdrawal of the air to avoid heating and upon the absence of sparking.

The following are the more important modifications of this original design of ozonizing apparatus, all the forms named being in actual use to-day in Europe for domestic or industrial purposes.

OZONIZING APPARATUS.

Siemens & Halske Ozonizers.—The ozonizer manufactured by this firm still keeps closely in design to the original invention of Werner von Siemens. It is of the tube type and the air current is passed along an annular space, in which the high-tension electrical discharge occurs. One glass tube has, however, been dispensed with, and an internal metal cylinder, separated by a slightly larger glass tube from the external cylinder of tinfoil, forms the ozonizing unit in each apparatus. The outer cylinder of the apparatus is surrounded with water, in order to keep down the temperature, and all the external parts are kept at the earth potential to reduce risks from shock.

Otto's Ozonizer.—The early form of the Otto ozonizer was based upon the use of rotating-disk electrodes which were provided with segmental openings by means of which any sparking that might occur was stopped before it had done much harm. Otto in his latest form of ozonizer, however, has adopted glass as dielectric, and his apparatus now consists of a series of sheets of glass, coated on alternate sides with tinfoil and separated by narrow strips of insulating material which allow an air-space between each adjacent sheet of glass.

Although plates of glass are used in place of tubes, the principle of this ozonizer is the same as that of the Siemens apparatus.

Rosenberg's Ozonizer.—This type of ozonizer differs from the preceding two in that glass is replaced by micanite and the continuous sheets of tinfoil or other metal which form the electrodes are replaced by copper or an aluminum-alloy gauze of forty meshes to the inch. Each complete element of the apparatus consists of a thin sheet of micanite covered upon each side by a square of this gauze. The air is caused to pass by means of baffle plates over a series of three or more of these ozonizing elements, and the electrical discharge at 4500 volts takes place in the air under treatment, without the presence of sparking. The absence of sparking under these conditions is said to be due to the large number of rounded projections of the gauze from which the discharge occurs, 230,400 to every square foot of ozonizing surface, or 900,000 for the usual size of the apparatus. The Rosenberg ozonizer is made in various sizes and forms and is manufactured and sold by "Ozonair" Ltd., a London company.

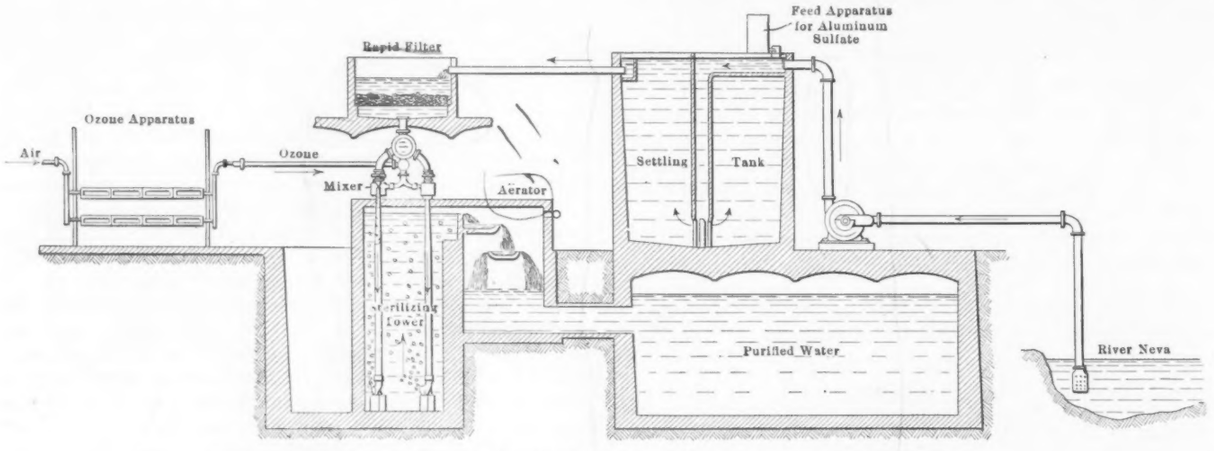


Fig. 1—Sectional Diagram of the Water-Purification Plant at St. Petersburg, Russia.

De Fries' Ozonizer.—This ozonizer resembles that of Rosenberg in the absence of any solid dielectric, each cell or unit being formed of a horizontal brass trough fitted with a plate-glass cover and provided with an external water-jacket. This trough is earthed and forms one pole of the apparatus. Half-disks of brass with serrated edges are suspended from the glass cover at equal distances along the length of the trough and form the other pole of the apparatus. When connected to a source of electricity at 2000 volts a silent electric discharge occurs between the sharp points of the semi-circular high tension poles and the inner water-cooled surface of the brass trough; and the air circulating through the trough is ozonized as it passes across the 4-in. space that separates the two electrodes.

Vosmaer's Ozonizer.—This ozonizer is another type in which glass is dispensed with, the silent discharge being produced by a series of points against a flat surface electrode. In this ozonizer sparking is prevented by special electrical devices. Each tube contains one flat and one pointed electrode, held at a fixed distance apart by porcelain stems and forks. The ozonizer consists of a number of these tubes grouped together on the feed-water principle.

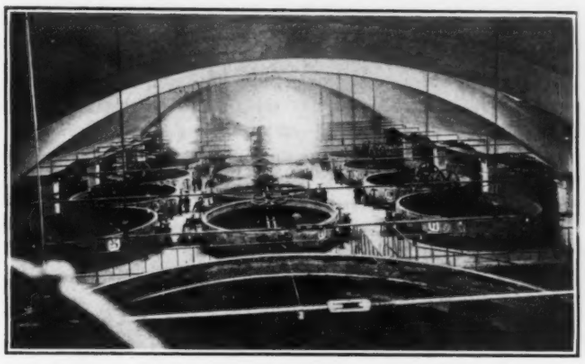


Fig. 2—Settling Tanks and Rapid Filters at St. Petersburg.

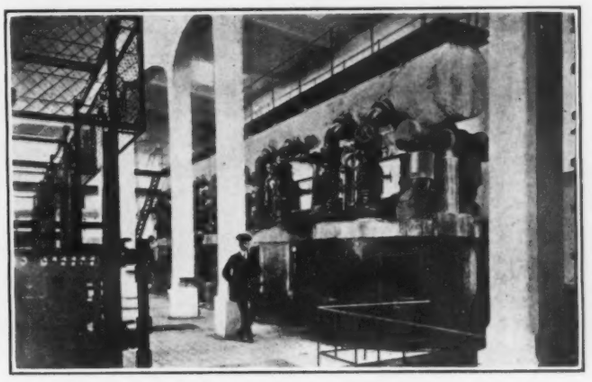


Fig. 3—Ozonizing Plant at St. Petersburg.

YIELDS.

As regards the yield of ozone, it can be calculated from thermochemical data that 1 hp-hour ought to yield 1030 grams. The best yield that has come under the writer's notice for the ozonizers described above is 184 grams per electrical hp-hour (for the Rosenberg type of apparatus); an average figure is about 100 grams or 10 per cent of the theoretical. The cost of producing this ozone depends largely upon the cost at which electrical energy can be supplied; the standing and running charges of an ozone-generating plant, apart from this item of energy cost, are moderate and need not be considered here. Taking the cost of the kw-hour at 3 cents, the energy required to produce 1000 grams of ozone will cost 6 cents when using the most efficient type of ozonizer and double or treble this amount when using less satisfactory forms of apparatus.

WATER PURIFICATION.

The most important application of ozone is for the purpose of water purification, quite a large number of installations of this character being now in operation in Europe.

The Siemens & Halske Company reports the following works in operation:

Weisbaden (1901), 1,320,000 gal. per day (used only as reserve supply).

Paderborn (1902), 660,000 gal. per day.

Hermannstadt (1909), 880,000 gal. per day.

St. Petersburg (1910), two plants, 2,640,000 gal. per day and 9,900,000 gal. per day respectively.

Florence (1911), 1,100,000 gal. per day.

In addition to the above, works of this character are now being erected for the municipalities of Paris, Chemnitz and Rovigo. A large number of private installations have been supplied, among those being Cambridge University.

The St. Petersburg plant is the largest and most important for water purification by means of ozone. It comprises 128 sets of ozonizing apparatus and five sterilization towers and supplies a district of the city consuming 11,000,000 gal. per day. The water is taken directly from the River Neva and the results so far are considered quite satisfactory. Figs. 1, 2 and 3 show various portions of the St. Petersburg works.

As regards other ozonizers used for water purification, the de Fries apparatus is installed at the water purification works at St. Maur, near Paris. This installation has a capacity of 6,000,000 gal. per day.

At Chartres and at Nice the Otto ozonizer is used, the first-named works having a capacity of 1,325,000 gal. per day and those at Nice a capacity of 10,000,000 gal. per day.

In the United Kingdom the purification of water by means of ozone has not been applied by any public authority; and the installation at Cambridge University is the only one in operation known to the writer. Ozonair, Ltd., manufacturer of ozonizers, states, however, that it has orders for three installations on hand, one of these being for a town in the north of England.

Figs. 4, 5 and 6—Various Kinds of Ozonizers.

Small portable water-sterilization plants for domestic and camp use are now being supplied by several firms, including the Siemens & Schuckert Company, the Lahmeyer Electrical Company, and Ozonair, Ltd., of London. These forms of water-sterilization apparatus are complete in themselves, and all that they require for operation is connection to an electric circuit and to the water-supply mains or pipes.

AIR PURIFICATION AND VENTILATION.

The peculiar smell observed when a static electrical plate machine is worked is due to the formation of ozone. This gas is also formed naturally during thunderstorms and in some unexplained way by the action of the sun and tides on long stretches of sandy shore and by the movement of clouds and air around mountain summits. In all these cases it is supposed a silent discharge of electricity occurs through the air and ozone is then produced in large or small amounts, according to the surrounding conditions. The amount of ozone found in the air is never great, but, when one considers the extent of the atmosphere, the total amount of ozone formed by natural agencies, under favorable conditions, must be exceedingly large. Ozone can always be detected by its peculiar odor in the air at many seaside and mountain resorts, and the invigorating character of these places is generally ascribed to the continual presence of this gas.

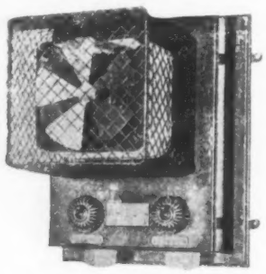


Fig. 7—Ozonair Apparatus for Air Purification.

Although it is quite impossible by artificial means to give the air of closed and crowded halls or rooms the freshness and bracing characteristics of the air of health resorts, there is no doubt whatever that much more might be effected in this direction than is yet attempted. By the installation of more efficient systems of ventilation and air purification, the fetid and germ-laden air which we at times have to breathe in crowded street cars, motor 'buses, railway cars, theaters, concert halls and other public places and buildings might be rendered far less poisonous and dangerous.

The ozone when produced by artificial means, in foul air, acts in two ways. As a concentrated form of oxygen it restores the balance between the oxygen and the inert or useless gases of the atmosphere and thus renders breathing easier, particularly for those affected with any heart, bronchial or lung troubles. Its more important services are, however, as a most active oxidizing agent and as a germicide. The minute particles of organic matter floating in the air of all places and buildings crowded with people (due to the exhalations from lungs and bodies) are rendered harmless by ozone, while a large number of bacteria and disease-producing germs are also rendered inactive or killed by this gas.

The purpose of this article is not to deal with systems of ventilation, though many of those at present in use provide a fine field for the application of scientific principles and for the installation of electrical machinery. The installation of one or more electric fans, churning up air already foul and creating drafts where they are least wanted, is not "scientific ventilation," but the reverse; and the sooner this is recognized the better for all concerned. The first essential of all systems of ventilation is that they shall substitute pure air for foul. Although the recognition of this fact has been long delayed, its significance and truth appear to have been at least realized in Europe and the progress which has been made in recent years with more scientific systems of air purification and ventilation has been considerable.

The writer believes that in time no public vehicle or building will be considered well equipped unless provided with adequate and efficient ventilating and air-purifying apparatus.

In Germany the well-known firm of Siemens & Halske is making a specialty of this kind of installations and has brought out several designs and sizes of ozonizer for air purification and ventilating purposes.

Figs. 4 and 5 show the forms used for ventilating purposes. In a recent publication relating to this application Messrs. Siemens & Halske give a list of thirty-four large installations of ozonizers for ventilation and air purification in Berlin and other places in Europe, the list including the German parliament house, the town hall at Amsterdam, the freezing chambers of the slaughter houses at Cologne, at Düsseldorf, Potsdam and Erfurt, and a number of theaters, concert halls, hotels, banks, etc. The largest of these installations is that of the German parliament house at Berlin, which supplies 200,000 cu. m (7,070,000 cu. ft.) per hour. The ice skating rink at the Admiral Palats, Berlin, is another big installation, producing 30,000 cu. m (1,060,500 cu. ft.) purified air per hour.

The "Playing Hall" at the Monte Carlo Casino is, however, likely to be better known in the United States than either of the above. An ozonizer installation, producing 2,121,000 cu. ft. of purified air per hour, is attached to this hall.

The Rosenberg ozonizer, previously described and shown in Figs. 6 and 7, is made by Ozonair, Ltd., London. This company gives a list of twenty-six installations of its ozonizers and apparatus for air purification in the United Kingdom and it also states that a large number of equipments are shipped to clients in the colonies and abroad. Among the list of London users are the following: D. H. Evans & Company, Oxford Street; Lloyds, the Royal Exchange, His Majesty's Theatre, the Piccadilly Hotel and the Royal Courts of Justice.

COST OF AIR PURIFICATION.

As regards the working costs of the two systems of air purification described above, Messrs. Siemens & Halske state that the electrical energy required for an ozonizer producing 1000 cu. m to 5000 cu. m (35,000 cu. ft. to 175,000 cu. ft.) air per hour ranges between 30 watts and 150 watts and that a complete ventilating equipment, including the fan, for a building requiring 21,000 cu. ft. of purified air per hour would take 175 watts. Ozonair, Ltd., gives 70 watts and 130 watts as the power required for installations producing 30,000 cu. ft. and 60,000 cu. ft. purified air per hour respectively.

The energy consumption decreases with the size, and a complete equipment yielding 189,000 cu. ft. of ozonized air per hour will require a power of only 590 watts.

These figures do not apply to the calculations of cost of the actual ozone, as the cost of concentration of ozone in the treated air is not stated. They show, however, that the cost of the air purification by means of ozone is not prohibitive and that in view of the benefits which may be obtained the cost is trifling.

It is important that the air should be filtered and dried before passing into the ozonizer, and some of the failures that have been experienced in the past have been due to neglect in this respect.

The absence of nitrogen oxides from the ozonized air is also imperative, since these oxides have a very harmful effect upon the mucous membrane of the nose and bronchial tubes.

ADDITIONAL CONDENSER TO IMPROVE PERFORMANCE OF STEAM TURBINE.

The St. Joseph (Mo.) Railway & Light Company has in operation a 1500-kw, two-stage vertical turbo-generator set, the steam consumption of which has proved excessive. This unit was one of the early models built and is believed to present so much clearance between its rotating and stationary parts that considerable steam leaks through without performing useful work. The presence of this surplus steam has been more than the 3200-sq. ft. surface condenser can handle at full load, so that the vacuum pressure has sometimes fallen as low as 22 in. to 24 in. of mercury, contributing further to the low efficiency of the unit.

To insure a good vacuum, improving the turbine's operation to this extent at least, the company is now providing the unit with a second condenser, which will have an area of 2000 sq. ft. This condenser is being connected to the former free-exhaust line, the relief valve having been removed and replaced at the far end of the new condenser. In case of pressure rise in the exhaust line the relief valve will thus permit the steam to exhaust through this second condenser and out into the atmosphere. In normal operation the 1500-kw turbine will in this way be served with a total of 5200 sq. ft. of condenser surface, which is expected to maintain a satisfactory vacuum at full load.

Cooling water for the condensers in the St. Joseph plant is supplied on a syphon-return system by motor-driven centrifugal pumps located in the pump house on the river bank, 600 ft. from the station. The two pumps, one 10 in. and the other 15 in., are controlled from the plant. The pipeline is 18 in. in diameter and is fitted with expansion joints.

Central Station
Management, Policies and Commercial Methods

CHURCH CONGREGATION RAISES FUND FOR ELECTRIC SIGN.

Recognizing the advantage of advertising its services according to the same successful methods used by local mercantile establishments, the congregation of the First Presbyterian Church of Joplin, Mo., has set about raising a fund of $500 for the purchase of an electric sign. The amount is being obtained by subscription among the members, and the sign, bearing the words "The Presbyterian Church," will be installed across the sidewalk in front of the edifice. "Churches, the same as commercial enterprises, should be advertised," declares Mr. James M. Evans, president of the local Presbyterian organization.

REMOTE MOTOR-OPERATED PUMP FOR BREWERY WATER SUPPLY.

The extreme flexibility of motor drive above all other forms of motive power is once again pointed out by a Louisville industrial pumping installation which furnishes water from a well of special quality to a brewery 3040 ft. distant. This brewery is located on the dry bed of Ballard's Creek, from which its supply was formerly obtained, but, with the use of the creek water for other industrial purposes at points above, recourse was had to the well above mentioned, the water of which is found especially valuable for use about the brewing plant. This water is raised by an air lift and is then conveyed the 3040 ft. from the well to the brewery by a 15-hp, three-phase induction motor-driven centrifugal pump, capable of delivering 200 gal. per minute. Service is supplied from the lines of the Kentucky Electric Company.

MARSH DRAINAGE BY ELECTRICITY.

What is known as the Pekin and La Marsh Drainage District consists of about 2500 acres of land along the Illinois River, near Pekin, Ill., and protected from overflow by a dike on the river bank running back to the bluffs at both ends of the district. This area is in charge of drainage commissioners who drain the land and keep it in condition for cultivation by pumping the water from the inclosure over the dike into the river. Thus at all stages of the river the land is available for agriculture. The first pumping plant in connection with this drainage system was driven by steam engines, but, as the cost proved too high, the engines were superseded by gas engines supplied from a producer plant. After a year's service the gas-engine equipment was in its turn replaced by electric motors supplied with energy by the Citizens' Gas & Electric Company, of Pekin, which is controlled by the Peoria Gas & Electric Company. The plant of the Pekin company is located on the opposite side of the river, and but a short distance from the pumping station. Since the electric motors were installed no trouble has been experienced in keeping the water out of the drainage district.

TRIAL OF LAMP-POSTS ON ONLY ONE SIDE OF STREET.

An interesting experiment was recently made in Chicago by the South Park Improvement Association and the University of Chicago on street lighting along Lexington Avenue, adjoining the university grounds. Some temporary removable lamp-posts were erected, each with a 250-watt tungsten lamp in an opal globe. These posts were first placed 125 ft. apart along the curb on one side of the street only. The general effect obtained in this way was noted, and then the installation was changed so as to place lamps on alternate sides of the street, using the same spacing of one post for every 125 linear ft. of street. It was the unanimous decision of an inspection committee of eight, consisting of engineers and others, that, in general effect and usefulness on residence streets, having the lamp-posts all on one side of the street was better than alternating them. This was largely owing to the greater contrast between illumination around the lamp and midway between, which resulted when the lamps were on alternate sides of the street. The cost of underground installation per mile of street is, of course, much less with the lamps all on one side.

TECHNICAL TERMS TO BE KEPT IN THE BACKGROUND IN SELLING.

In a recent address before the Milwaukee Electric Railway & Light Company Section of the National Electric Light Association Mr. Egbert Douglas, commercial engineer of the company, made some interesting observations on selling electricity for lighting. In order to get an audience, said Mr. Douglas, the solicitor must be "on to the

curves" of a successful salesman. He cannot open doors by announcing that he is Mr. Kilowatt. The speaker went on to say:

"In talking with a prospective customer one must be guarded in using technical terms, because usually they are unintelligible and therefore tiresome. To explain in an offhand way the meaning of a technical term which you use is a courtesy you owe to your prospective customer. If he is familiar with it he will at once give a reply that indicates as much. You are on safe ground thereafter. Much of the mystery which surrounds the use of electricity is due to the fact that the contact of the public has been too much with technical men. The job has been over-engineered. The endeavor of a salesman should be to strip his proposition of all technical language, as far as possible, and to define those terms which he must use in stating his proposition."

THE "FRICTIONLESS" TREE-TRIMMING SEASON.

In some parts of the country the early part of the fall of 1911 seems to have given an unusual amount of trouble from trees growing into contact with electric wires. This has probably been due to the rapid growth following plentiful rainfall after a drought. At any rate some electric-service companies have had difficulty in trimming trees away from their lines fast enough to keep ahead of the growth. In addition to the natural difficulties encountered in keeping clear of tree branches and twigs there is the ever present artificial difficulty, viz., the objection of the property owner to having his trees trimmed. In some cities and towns the trimming of trees on the public streets is a matter under the charge of some city officer or committee of the Council independent of the property owner. In either event the trimming of trees is a matter to tax to the limit the diplomacy of the public-service company manager and he should see to it that the task is not entirely given over to linemen with more zeal than tact. Unless the head lineman is possessed of unusual tact it is best for the manager of the small company, or some special representative in case of the large company, to go in advance of the tree-trimming gang and arrange with the property owners. It is sometimes the case that by volunteering to do some additional tree trimming besides that immediately around the wires permission to trim will be readily obtained where otherwise it would be withheld. While this adds to the work of tree trimming it doubtless pays because of its effect on public good-will.

Another thing it is well to remember is that the season of "frictionless" tree trimming is when the leaves are off the trees. The average property owner will object much less to tree trimming at such times than during the summer, when he feels that he wants all the shade it is possible to get and resents having any little portion taken away.

OMAHA'S CURBSIDE FEEDER TIE SWITCH.

With the exception of a 500-volt "power" circuit, the downtown central-station service of Omaha, Neb., is all alternating current, supplied through manhole transformers from 2300-volt feeder lines carried underground through the alleys of the business section. These feeders thus run parallel at one-block distances through the underground district and are numbered according to the "hundreds" of the house numbers in the blocks which they cut.

As a precautionary measure, so as to assure partial service at least in districts served by a feeder that has burned out or grounded, all of the feeders are intercepted along the main street by a crosstown emergency tie feeder, through which, by switches at the curbs, any damaged feeder can be energized after its damaged section has been isolated by other curbside switches. This distribution arrangement is best shown by the accompanying sketch, Fig. 1. Into each of the alley feeders curb-side oil switches of the type illustrated in Fig. 2 are inserted at the intersection of their respective alleys with Ninth and Fourteenth Streets. These switches are normally kept closed. The

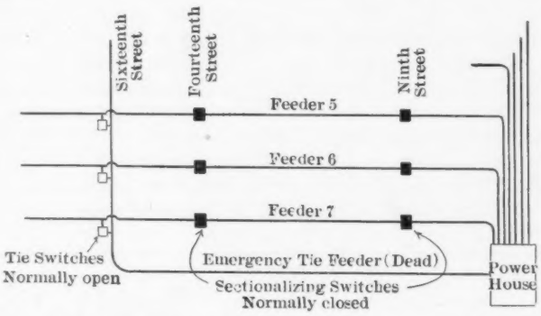


Fig. 1—Scheme of Feeder Layout in Underground District, Omaha.

emergency tie feeder crosses the seven alley feeders at Sixteenth Street, in the heart of the business section, and at each such intersection taps from both lines are brought up to similar "tie" curb switches. These switches are normally kept open.

The alley feeders are only single-phase circuits, but the tie feeder (which is ordinarily held "dead" as a guard against damage) is a three-phase 250,000-circ. mil lead-and-paper-covered cable, taps from its phases being brought up to the tie switches corresponding to the phase of the feeder to be connected.

One of the 2300-volt curb-switch pedestals is shown in Fig. 2. The switch itself is a standard 6600-volt type, oil-break, two-pole device, operated by an arm-handle, the position of which indicates whether the switch is open or closed. The pedestal cabinets in which these feeder switches are mounted are of cast iron and measure over all about 5 ft. in height. They are, however, in little evidence to the casual passer-by. Indeed, one may spend several days in Omaha without noticing the presence of the

Fig. 2—Omaha Curbside 2300-Volt Feeder Tie Switch. Pedestal Open.

pedestals on the streets. They were cast locally from designs made by the Omaha Electric Light & Power Company's engineers, and cost $27 each. Altogether about thirty of these curb-switch pedestals are installed in the city. The hinged doors are provided with block latches, beside special locks, the keys to which are carried by men

of the company's underground department. A tag attached to each switch handle describes the location of the switch, together with its normal position, whether open or closed. The switch photographed in Fig. 2 was, as shown by the stenciling, the emergency tie connection between the tie

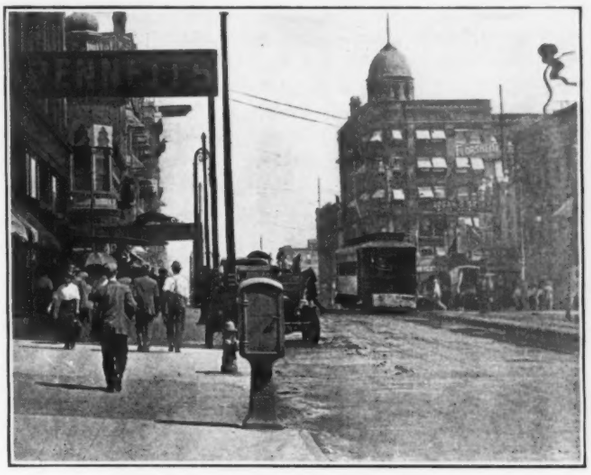


Fig. 3—Switch Pedestal in Business Section.

feeder and alley feeder No. 4, the latter tap being brought up on the left and the emergency tap on the right of the oil switch. This clear labeling at once informs any company representative unfamiliar with the lines of the position of all parts.

The practical use of the feeder switches will be clear from the sketch. If a feeder, for instance, goes bad between Fourteenth Street and Ninth Street the section can be cut out by opening the two switches at these points. Meanwhile the emergency feeder is energized and the switch connecting it with the circuit in trouble is closed, restoring service to all parts of the feeder not directly involved in the breakdown. A similar system of emergency switches has been carried out on the overhead-pole lines of the Omaha company and is found to be very valuable in maintaining partial service during injury and repairs to a feeder circuit.

ELECTRICITY IN SAN FRANCISCO'S "CHINATOWN."

In the rehabilitation of the celebrated quarter of San Francisco known as Chinatown electricity is accomplishing not a little in the way of improving conditions of illumination and power utilization. Since the almost total destruction of this noted section of the city by the fire which succeeded the great earthquake of 1906, both Occidental and Oriental enterprise have been hard at work in modernizing the district. Many new and attractive mercantile buildings have been erected and equipped with gas and electric lighting; electric power is gradually being installed in small shops which formerly depended wholly upon manual labor; and the telephone's popularity has become so great that one of the chief sights of Chinatown is a small exchange housed in a pagoda type of building, with Chinese operators and supervision. Even the innermost throne room of the powerful Chinese Benevolent Association is equipped with a portable private telephone which connects the ruling authorities of the district with the outside world.

Practically all the electricity supplied to Chinatown is furnished by the local central-station systems of San Francisco. Both the Pacific Gas & Electric Company and the City Electric Company of San Francisco are actively engaged in securing new business, the former company in particular having on its staff a highly skilled Chinese gas and electric solicitor who works the territory in close association with the American solicitor having immediate supervision of the Chinese quarter. The present Chinese solicitor is Mr. Lee Ling, an experienced interpreter who

Fig. 1—Motor-Driven Noodle Factory.

is specially posted on the commercial phases of central-station service and who acts as an informal information bureau, court of appeal and emergency representative of the operating department.

The attractions of Chinatown as a center of tourist interest are so great that electric-sign and outline lighting

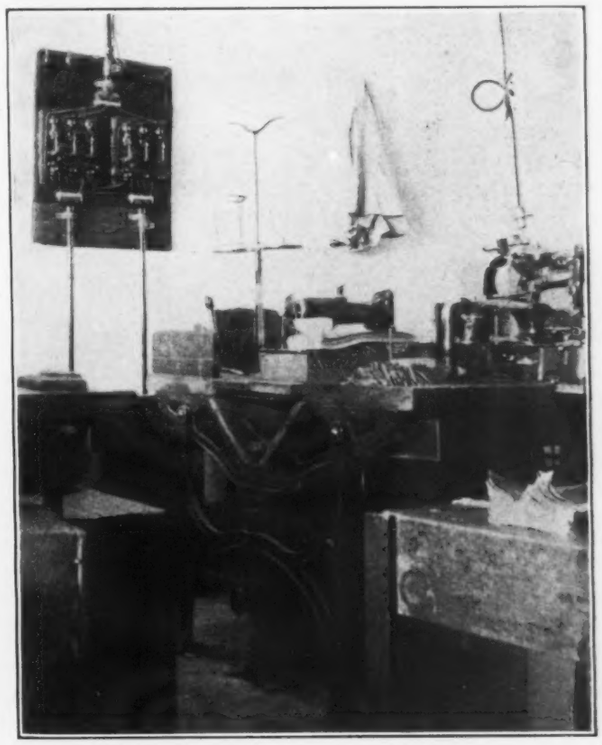


Fig. 2—Motor-Driven Sewing Machines.

are coming into rapid utilization. The accompanying photograph shows the extent to which advanced methods of window and outline lighting have been established in the Grant Avenue and Dupont Street section. The large mercantile retail house of the Sing Fat Company, shown at

the left in the illustration, is equipped with 1341 13-watt incandescent lamps for exterior illumination, 396 50-watt lamps and sixteen 26-watt lamps for interior illumination. A 10-hp electric elevator is also operated in this establishment, and six 5-amp arc lamps are in regular service. The Sing Chong Company, a wholesale and retail house in the same district, operates nightly 2500 13-watt lamps, ten Nernst lamps of the four-glower size and 12½ hp in electric motors. The Canton Bazaar operates 802 13-watt lamps on the outside of the building and 360 lamps of from 7 watts to 25 watts rating elsewhere. The outline lighting of the pagodas of these establishments is the source of many favorable comments from tourists seeing Chinatown during the evening, and the business is attractive from the central-station point of view on account of its protracted character, the season being practically continuous throughout the year and the demand well sustained through the evening hours. Electric signs are used to a considerable extent by Chinese restaurants in advertising chop suey and other gastronomic attractions peculiar

Fig. 3—Electric Lighting in Chinatown, San Francisco.

to the district. Street lighting by grouped installations of tungsten lamps mounted on iron poles with translucent globes has also attained some favor in the better-lighted portion of Chinatown.

The use of electric motors in Chinatown is at present confined largely to the operation of sewing machines and to the running of machinery in noodle factories. At present there are about a dozen factories in Chinatown for the production of underwear, overalls and miscellaneous clothing. In a representative shop twenty-eight sewing machines are belt-driven in two groups by two 2-hp, 220-volt, three-phase induction motors mounted on a platform in the basement below the sewing-room, all the wiring being in conduit, with condulet fittings and inclosed fuses. In another shop of the same character producing forty dozen pairs of overalls daily sixteen sewing machines are belt-driven by a 2-hp, 220-volt, direct-current motor, a 3-hp motor being used in driving two buttonhole machines. Conduit wiring is also used in this installation.

At the Canton noodle factory a 2-hp, 220-volt induction motor drives on the group plan a dough-mixer, a roller and a noodle machine, the motor being located in the basement and controlled by a starting switch in the machine-room. Probably the largest noodle factory in Chinatown is the San Francisco branch of the Hong Kong noodle factory, which is equipped with a dough-mixer, cutter and two noodle machines, belt-driven through a countershaft from a 5-hp, 220-volt induction motor mounted on a platform above the level of the operators' heads. The long-hour operation of these factories renders them desirable customers of central-station service, since the revenue derived from even a small motor operated for many hours daily tends to exceed that secured from a larger plant run intermittently. The prevailing opinion that many dark mysteries may be found in Chinese food products of the simpler type is soon dispelled by a visit to one of these motor-driven establishments, in which the cleanliness of the electric drive is a factor which appeals forcibly to the proprietors apart from its value as a source of steady and economical motive power.

Wiring and Illumination

DISADVANTAGE OF GAS-LIGHTING IN THE MATTER OF HEAT.

Addressing the Milwaukee Company Section of the N. E. L. A. at a recent meeting, Mr. Egbert Douglas, sales manager of the Milwaukee Electric Railway & Light Company, gave as one reason for the superiority of electricity in competition with gas for lighting the fact that the former radiates only about one-eighth as much heat for the same quantity of illumination. In a store the heat of gas "arcs" is sufficient to raise the temperature from 3 to 5 deg., and this in summer has a marked effect in diminishing the number of customers entering the store. If the net monthly profits are $200 a month they will be reduced $20 a month if one person in ten avoids the store owing to the heat of the gas lamps. Obviously, therefore, electric light is worth $20 more a month than gas. It may be assumed also that the effect of diminished sales will continue through the whole year, for it is reasonable to suppose that those who avoid the gas-lighted store will acquire the habit of buying elsewhere. Speaking of the effect of high temperature on sales, Mr. Douglas mentioned the fact that the soda fountain which does the most business in a certain city cools the store by using about four times as much energy for electric fans as the average soda fountain.

CONDUIT WIRING TO BE REQUIRED IN BUILDINGS OF CERTAIN CLASSES IN PITTSBURGH.

The Department of Public Safety, Bureau of Electricity, of the city of Pittsburgh, Pa., has just issued, in the form of a circular letter, a supplement to Rule No. 24, page 76, of the Pittsburgh Wiring Manual of 1910, which modifies the existing requirements affecting the method of installing wiring in certain classes of buildings. It also makes a new regulation regarding the locating of switches in school buildings. The text of the letter is as follows:

"On and after Dec. 1, 1911, all buildings used for schools, auditoriums, churches, places of amusement, garages, storerooms, storeroom-dwellings, apartments, warehouses, office buildings and places of business must have wiring installed with rigid conduit, flexible steel conduit or armored conductors with the necessary fittings, including outlet boxes, condulets, bushings, lock-nut and all other fittings necessary to make a complete and perfect job of

conduit installation. In places where the work is exposed metal molding with approved fittings will be allowed.

"In all buildings used for school purposes switches controlling each circuit must be placed on the tablet board; said tablet boards must be placed in hall on each floor and must contain the requisite number of switches controlling lamps in each room on said floor."

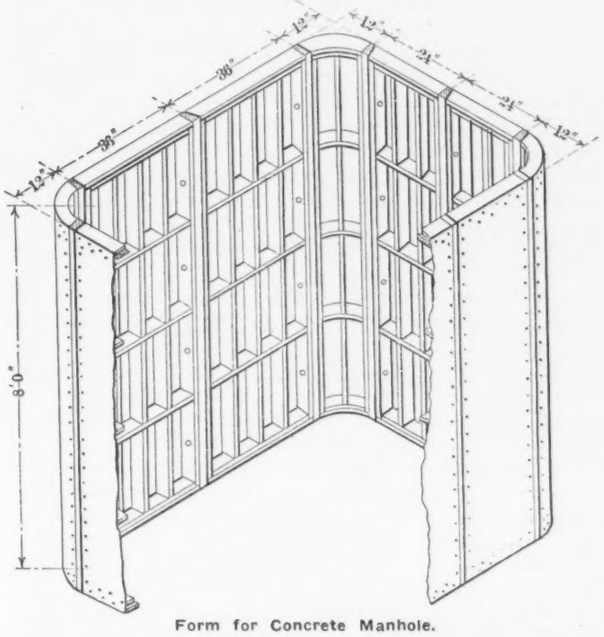
It is understood that the placing of switches on tablet boards in school building halls is to be required, so that the switches will be inaccessible to the school children. Some difficulties have been experienced in the past due to the youngsters playing with the switches.

FORM FOR BUILDING CONCRETE MANHOLES.

By W. P. MUNGER.

As the building of concrete manholes becomes more general engineers are confronted with the problem of forms. If a special form is built up for each manhole the cost is high, and if a standard form is made, so as to make all manholes of the same size, some manholes will be altogether too small for the cables entering them and the transformers they must hold.

To meet this demand of adaptability, low first cost, low cost of operation and maintenance, the form shown was designed and used on some recent conduit installations. The form is built up of four kinds of members, 3-ft. side pieces, 2-ft. side pieces, corner pieces and wedges, all of the members when in place being 8 ft. tall. The 3-ft. and 2-ft. side pieces are made of a framework composed of ⅞-in. by 4-in. dressed pine, securely nailed and covered with No. 24 gage galvanized iron nailed on with galvanized nails. The



Form for Concrete Manhole.

corner pieces are similarly constructed, except that the covering is bent to 12-in. radius, so as to give round corners in the finished manholes. The wedges have a 1-in. face and 1½-in. back and are drilled with 7/16-in. holes to match those drilled in the corner and side pieces. For assembling in the hole sufficient ⅜-in. by 6½-in. carriage bolts, with thumb nuts and washers, are provided to bolt each member to each of its neighbors four times. For assembling there must also be provided sufficient braces, but as they can be used again and again their cost is negligible.

In using these forms, which are set up and taken down by common labor, it was found that the wedges became so tightly bound that the men removed them with picks, and several wedges were destroyed in this manner. The cost of new wedges is small, however.

By properly choosing the units the sides of manholes having a floor area of from 4 ft. by 4 ft. to 12 ft. by 12 ft. (by even feet) can be poured.

ILLUMINATION FOR READING REQUIRED BY DIFFERENT EYES.

By J. R. CRAVATH.

In a paper before the last convention of the Illuminating Engineering Society, at Chicago, in October, 1911, the writer reported the results of tests on twelve different persons or "subjects" to determine the amount of light required for reading under several different conditions. While those tests were primarily for the purpose of determining the influence of different lighting systems and surroundings upon the light required, they were also intended to show the variations between different individuals, which must be provided for in practice when designing the illumination system of any large office space used by a number of persons. For the benefit of those not familiar with that paper it may be said that the tests failed to reveal any decided difference in the illumination required with direct as against indirect lighting for medium-sized office spaces under ordinary commercial working conditions. The results effectually disproved the theory which has been held by some that more illumination is required with ordinary commercial indirect lighting than with a direct-lighting system. The tests further indicated very strongly that the glare received from the paper which was being read obtruded itself in such an annoying manner that in most cases it caused the subjects under test to call for more light than was called for under less annoying conditions. Yet under none of the conditions in these tests was the glare sufficient to be distinctly noticeable or to prevent reading.

Glare from paper is more or less present with both direct and indirect systems, but the more diffuse the illumination and the smaller the amount of light received on the paper from one direction the less the amount of annoying glare which it is possible to receive from the paper. Less trouble from glare from the paper is therefore likely to be experienced with indirect diffused lighting systems and with direct lighting from a large number of scattered small units than with those in which a considerable portion of the light at any point is received from one direction. It is, of course, true that it is quite possible to avoid glare from the paper by shifting or tilting the paper to such an angle that the regular reflection from the glass does not enter the eye. We do this instinctively as a rule, but in general office desk work it is frequently inconvenient to do so. Furthermore, we reduce the illumination of the page by so doing, which naturally raises the question whether a system of illumination highly efficient as measured by photometer and wattmeter is really the most efficient if a considerable portion of the efficiency has to be thrown away to get comfort. In other words, shall we sacrifice our efficiency at the reading page or in the system of lighting itself? These are points which are certainly worth further study.

In the tests before referred to the writer found that under the most favorable conditions, with the least amount of glare reaching the eye from the paper, the minimum amount of illumination considered comfortable for continuous reading varied in the twelve subjects tested from 0.42 ft.-candle to 1.48 ft.-candles. The amount considered ample by the various subjects varied from 0.72 ft.-candle to 2.37 ft.-

candles. This certainly shows a great difference in eyes and accounts for some of the troubles illuminating engineers have had in trying to suit a number of people working in the same office under the same conditions. The opinion was expressed by the writer in the paper referred to that subjects could doubtless have been found had time permitted which would have required even more light than any of the twelve tested. I am informed by oculists that the retina usually becomes less sensitive with advancing age, and that this lack of sensitiveness cannot always be made up for by the use of glasses.

Since my convention paper I have had opportunity to make reading illumination tests on a subject forty-seven years of age who required much more light than any of those in the previous tests under similar conditions. The conditions of the tests were not identical with those of the previous twelve, but were sufficiently close to serve all practical purposes. The tests were made in a room having light cream ceilings, which was about 15 ft. square and had walls 8 ft. high. A single lamp with a clear prismatic reflector was placed about 2 ft. from the ceiling at the left of the subject, and the latter received no glare from the paper. The *Saturday Evening Post* regular reading type was used, as in the former tests. The light was dimmed by means of a rheostat and then raised to the values selected by the subject. This subject required an average of 3.6 ft.-candles as the minimum amount comfortable for continuous reading and 4.5 ft.-candles as the amount considered ample. This subject has worn glasses for many years for reading; in youth he was near-sighted, but he is now far-sighted when unaided by glasses. The subject in the five tests made showed a very small percentage of variation from the average, and seemed to have a very definite idea of the amount of light required. He could not read at all without conscious eye strain at values which any of the subjects previously tested would have considered ample.

These tests simply show what latitudes of individual requirements must be provided for when designing illumination systems. The writer has good reasons to believe that subjects could be found who would require more light than the one just tested. It is necessary now for illuminating engineers and their clients to ascertain how far any system of general illumination should go in meeting the desires of certain individuals requiring an abnormal amount of light. That there should be a limit somewhere goes without saying. At the present time this feature is undoubtedly one of the most troublesome elements involved in the design of the illumination of large offices.

REMOTE CONTROL OF ORNAMENTAL BLOCK LIGHTING AT PEORIA, ILL.

Five city blocks in Peoria, Ill., are now equipped with ornamental post lighting, six standards on each curb of each block. Each post carries four 60-watt tungsten lamps and one 100-watt tungsten lamp, the latter burning all night, while the former are extinguished at midnight. The lamps are operated at the expense of the city, but were installed by the adjoining property owners at a cost of $2 per front foot, the conduit being laid coincidently with the repaving of the streets. As a result of these first five blocks of ornamental lighting it is understood that at least twenty-five blocks additional are planned to be similarly equipped.

The group of six posts on each curb of the present installation are controlled from a solenoid-operated switch, all ten of the group circuits being thus manipulated directly from the power plant for turning on and off the all-night and the till-midnight lamps. The movement of the solenoid in these switches is opposed by a spring, and all the windings are connected in series by an extra wire pulled through the conduit runs. To light all the lamps on the posts a current of 8 amp is sent through this control circuit, pulling the solenoids to their extreme position, where contacts are made to light all the lamps. After 12 o'clock the control-current strength is reduced to 4 amp, thereby allowing the spring to pull the switch off the contacts for the 60-watt lamps but keeping the 100-watt lamps in service at the tops of the posts. This scheme, of course, requires a sustained current to hold the switch on the "on" positions. Experiments are now being made with an improved switch, in which a momentary impulse serves to close and open the respective contacts, the control circuit being at other times dead.

Other local experiments have taken the form of impressing superimposed alternating currents of different frequencies on the main lighting circuits to operate harmonically adjusted switches. The Peoria Gas & Electric Company has a number of flat-rate display lighting services, which must now be turned off by patrolmen at various hours, and these it is hoped to control from the power house, shutting off the 9, 10, 11 and 12 o'clock services at their respective hours by the aid of impulses over the lighting mains and without disturbing other installations.

The Peoria company also has in service a number of single-unit multiple-type boulevard lamps on one of the principal residence thoroughfares of the city. This multiple circuit is lighted and extinguished at the same hours as the regular city arc lighting, being controlled from a solenoid switch, inserted in series with the arc circuit, which closes when the arc lamps are lighted. An arrangement similar to this, used at Toledo, Ohio, was described and illustrated in the *Electrical World* of Oct. 20, 1910.

LETTERS TO THE EDITOR.

Visual Acuity and Pupillary Aperture.

To the Editor of Electrical World:

Sir:—I am much interested in running over Professor Ashe's contribution to this subject in your issue of Oct. 28, which is certainly not without importance, particularly in its bearing on the use of acuity photometers. However, I must again call attention to the fact that the conditions in my own experiments, quoted in the *Electrical World* of May 11, entirely eliminated all questions of this sort. In these experiments the settings were made for equal acuity on contiguous reading targets illuminated by the two lights respectively, which targets were viewed simultaneously by the same eye. The two were, therefore, always viewed with identical pupillary aperture so far as a given balance was concerned, this aperture being determined by the conjoint illumination from the two sources. There was not the slightest opportunity, therefore, for any differential effect due to pupillary aperture, and the absolute size of the pupil was a matter of no importance, since if it affected acuity at all, the two targets were necessarily affected simultaneously and to the same degree, from the very conditions of the experiment.

The diaphragm which was used merely had the effect of holding the actual working aperture of the pupil steady so that similar conditions would exist in successive readings under varying illumination. As a matter of fact, its presence was not found to exercise any perceptible influence on the acuity observed, doubtless because the pupillary aperture, within the range of illuminations used, did not vary enough to affect materially the absolute acuity.

In a non-simultaneous comparison of acuity values I am inclined to think the use of the stop would always be advisable as a precaution, particularly in dealing with very faint illuminations where the pupil naturally works at considerably widened aperture. There is no doubt that varia-

tions in pupillary aperture do affect the absolute value of acuity very perceptibily in working without a diaphragm in varying light. The cause of this condition is perfectly well known, being simply that the refracting system of the eye is afflicted with zonal aberrations which come into play when the pupil is sufficiently widened. For this reason the eye ordinarily becomes somewhat myopic in very dim light. There may be in cases of astigmatism a material change in the errors of refraction due to that cause also. These variations render absolute acuity measurements troublesome, and it was because of them and the difficulties due to varying adaptation that I resorted to the balance for equal acuity, which eliminates both. Attempts at measuring absolutely pupillary aperture are so unsatisfactory, as Professor Ashe indicates, and as everyone who has experimented with it has found, that it is hard to understand how anyone could seriously have proposed such measurements as a basis for photometry; yet, strange to say, this has been done.

I am glad to note that Professor Ashe adheres to his steady, and I think well-founded, faith in the flicker photometer as an instrument for heterochromatic measurements. It may not be altogether perfect, but it seems to me to be open to fewer objections and to show fewer troublesome sources of error than any other instrument yet devised for such use.

In closing I would suggest to any readers of the *Electrical World* who may want to follow up this interesting matter of the pupil and its reactions to get and study Ludwig Bach's "Pupillenlehre." It is a very thorough and judicial résumé of the present knowledge of the subject, and particularly rich in references to the somewhat scattered literature.

Boston, Mass. LOUIS BELL.

Condensation in Interior Conduit.

To the Editor of Electrical World:

SIR:—I notice in your issue of Oct. 7 a note entitled "Condensation in Rigid Conduit," from which I gather that in your country there is the same trouble from condensation in steel and iron conduits which is experienced in England.

Over twelve years ago the Sun Electrical Company, Ltd., investigated this complaint, and, as the outcome of experiments lasting over a considerable number of years, it introduced in 1907 the "Kalkos" system of conduit wiring. In this system the tubes are made of brass of special composition tinned inside and out. Owing to the high heat conductivity of these tubes the temperature inside quickly follows that of the atmosphere, and thus there is no cooling of the air and condensation does not take place. Moreover, the system is absolutely watertight when correctly installed even at the switch and light points.

Your contributor suggests using weatherproof insulation; this, too, is recommended by the leading steel conduit makers in this country, and cable manufacturers are also making special weatherproof cables for drawing into steel and iron conduit. We, on the other hand, recommend the use of taped wires only—that is, wires taped but not braided—and many hundreds of miles of this class of cable have been drawn into "Kalkos" conduits without any signs of breakdown. We, moreover, give a guarantee to replace all wires of standard grade which fail owing to condensation, if installed under our standard specification.

Regarding earthing, the whole system is earthed, and owing to the high current-carrying capacity of the tubes, which in most instances is greater than that of the installed wires, the grounding is ideal. Dollies of all switches are earthed so that there is absolutely no risk of shock even should they break down. Our switch, it may be added, is an ordinary tumbler, but at the same time is absolutely watertight.

The "Kalkos" system is being largely installed in England in factories, breweries, laundries and places where screwed iron tubes have failed owing to the bad conditions, and in no case has there been any complaint regarding this system.

London, England. E. R. MORTON.

Digest of Current Electrical Literature

ABSTRACTS OF THE IMPORTANT ARTICLES APPEARING IN THE ELECTRICAL PERIODICAL PRESS OF THE WORLD

Generators, Motors and Transformers.

Speed Regulation of Large Induction Motors.—A. HEYLAND.—The author gives a review of a system which he has developed in connection with the Siemens-Schuckert Com-

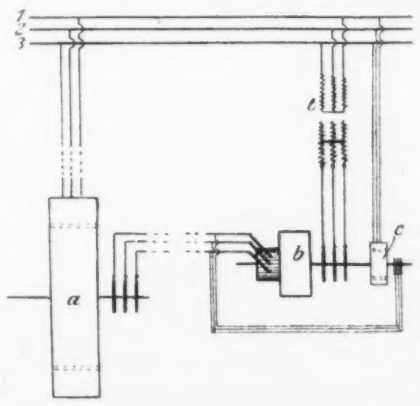


Fig. 1—System of Speed Regulation.

pany. The system is especially applicable to plants in which speed regulation of induction motors of such large output is required that commutator motors could not be used. The system is shown in Fig. 1, where *a* is the main induction motor to be regulated, 1, 2 and 3 are the conductors of the three-phase supply network, and *b* is a frequency changer in form of a commutator motor driven by a small induction motor *c*. The primary of the driving motor *c* is connected to the network, while the rotor is connected to the rotor of the main motor *a* so that it must revolve with the same positive or negative slip as the main

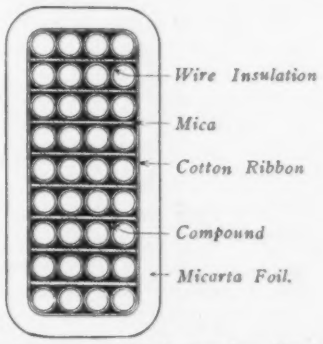


Fig. 2—Insulation of Coils for High-Tension Machines.

motor. The frequency change *b* is a commutator motor, the commutator brushes of which are connected to the rotor of the main motor *a*, while the slip-rings of the commutator motor *b* are connected to the network through the inter-

mediary of the adjustable transformer *t*. The differences of this arrangement from others are discussed and the excellent utilization of the active material and the high efficiency are claimed to be special advantages of this system.—*Elek. Zeit.*, Oct. 19.

Insulation of Coils for High-Tension Machines.—K. Perlewitz.—It has been repeatedly found that the insulation of coils of high-tension machines may break down in time owing to chemical changes. It has further been found that these chemical changes occur only when there are spaces filled with air in the interior of the coils. All the troubles may be avoided by eliminating these air spaces. The firm of Emil Haefely in Basel uses the arrangement shown in Fig. 2, in which air spaces within the coils are entirely avoided and the conductors as far as they are placed within the slots are covered with an insulating layer corresponding to the slot cross-section. The external insulating cover of the coil is made from so-called micarta foil. Micarta foil consists of a carefully selected paper 0.04 mm in thickness covered with fine mica sheets of 0.08 mm thickness by means of a special varnish. The spaces between the different conductors are first completely filled with a compound, a layer of cotton ribbon is then wound around the coil, and finally the coil is covered with a layer of micarta foil. By means of a process which may be compared with the use of a flatiron the coil is heated under application of pressure whereby the whole coil becomes a solid unit without any air spaces.—*Elek. Zeit.*, Oct. 12.

Lamps and Lighting.

Metallic-Filament Lamps.—An article on a recent reduction in the prices of metallic-filament lamps in England. In the case of osram lamps the list price of the 200-260-volt, 32-watt, 40-watt and 55-watt lamps has been reduced to 75 cents (instead of 93 cents and $1), and the 100-135-volt, 17-watt, 25-watt, 32-watt and 55-watt sizes are now sold at 62 cents. The price of the new 200-260-volt, 20-watt lamp is 81 cents. Similar reductions have been made in other types and makes of metallic-filament lamps. Thus tungsten lamps with drawn-wire filaments are now sold at 62 cents each for the 100-125-volt, 17-watt, 25-watt, 30-watt, 40-watt and 60-watt sizes, and at 75 cents for the 200-260-volt, 30-watt, 40-watt and 60-watt sizes. Tantalum lamps from 200 volts to 250 volts sell at 75 cents.—Lond. *Elec. Eng'ing*, Oct. 19.

Sealing Wires Into Glass.—A note on a recent British patent (1880, Oct. 12, 1911) of G. B. Burnside. The wire is placed through a small aperture in the glass or other vitreous substance and heated by a blowpipe flame until perfect cohesion between the two takes place. The seal is then removed from the flame, and when at a dull red heat it is cooled by gradually increasing immersions, of about two or three seconds' duration, in some sperm or similar oil or in wax. For currents above 15 amp round tubular conductors, plugged with a conducting material, are employed. This form is very useful for mercury-vapor lamps or rectifiers, as the tubular cell is made of a substance that does not form an amalgam, and thus protects the copper from the mercury.—Lond. *Elec. Eng'ing*, Oct. 19.

Generation, Transmission and Distribution.

Electric Winding Machines.—W. Philippi.—The first part of a paper read before the Berlin Electrical Society on the different systems of electric winding. The author first discusses the use of the induction motor, although it has not found favor in Germany for winding purposes. He then takes up the use of the three-phase series motor and the double-commutator motor of Deri. All these motors need a gearing since they cannot be built for such low speeds that they can be coupled directly with the winding axle. The author then takes up the discussion of the use of direct-current motors, which are being employed to a far greater extent for winding machines, in connection with the well-known Ward Leonard system. The paper is to be concluded.—*Elek. Zeit.*, Oct. 19.

Energy Transmission to Rome.—J. Reyval.—An illustrated article on the Tivoli-Rome and the Subiaco-Rome transmission lines, which are worked in parallel. The tramways of Rome are supplied with energy from the system by means of a converter station operating in parallel with a storage battery. The tramway load has improved the power factor.—*La Lumière Elec.*, Oct. 14.

Traction.

Tramway Convention.—Zehme.—An account of the thirteenth annual convention of the German Association of Street Railway and Light Railway Companies. Among the engineering papers presented at the convention there was one by Drewes on the use of motor-cars on light railways, one by Lehrmann on interpole motors for traction, one by Kayser on lighting systems for electrically operated light railways (the use of metallic-filament lamps being advocated), one by Draeger on lighting systems for steam-operated light railways (the use of acetylene lighting being advocated), and a paper by Eichel on the development of alternating-current railways.—*Elek. Zeit.*, Oct. 12.

Interpole Motors for Traction.—Lehrmann.—An abstract of a paper presented at the recent convention of the German Association of Street Railway and Light Railway Companies. The results obtained with interpole motors by fifty-six German companies with 6372 motor cars are given. One thousand two hundred and forty-one of these cars are now equipped with interpole motors. The number of those companies in which more than 20 per cent of the motor cars are equipped with interpole motors has increased in the last two years from six to thirty. The expected favorable effects on the cost of maintenance due to the use of interpole motors have already manifested themselves, improvements being shown in the time spent for attendance and cleaning of the commutators and in the life of the brushes. In several new plants higher emfs than the usual 500 volts or 600 volts have been employed with success. One plant has been changed from 550 volts to 750 volts. The question as to the saving of energy with interpole motors has not yet been finally settled. The only real disadvantage of interpole motors is their higher cost, and the question was raised whether this higher cost is compensated by sufficient savings in operation. All companies with the exception of eight have answered this question in the affirmative. Of the eight companies that did not so answer, four did not reply at all. Two do not yet want to commit themselves and one company answers the question in the negative.—*Elek. Zeit.*, Oct. 12.

Municipal Tramways.—James H. Rogers.—A paper presented before the (British) Municipal Tramways Association. The author analyzes the financial results obtained on the eighty-eight municipally operated tramways in England, of which undertakings twenty-six have no reserve fund at all. He shows that a substantial reserve and renewals fund is essential for sound finance in connection with electric tramways, and considers that $1,000 per mile of track per annum is a minimum provision. The question of 1-cent fares and workmen's fares and also that of contributions to the rates are discussed.—Lond. *Electrician*, Oct. 20.

Electric Traction.—J. Simey.—Illustrated descriptions of some new electric-traction installations, especially the single-phase locomotive of the Dessau-Bitterfeld road and the electric equipment of the Bern-Simplon road with the Loetschberg tunnel, consisting of Siemens-Schuckert motor cars, a locomotive of the Oerlikon Company and a locomotive of the Allgemeine Elektricitäts Gesellschaft.—*La Lumière Elec.*, Sept. 30 and Oct. 21.

Parma.—An illustrated article in which the various details of a new tramway which has recently been set in operation in the streets and suburbs of Parma, Italy, are described. Single-phase current is used throughout, the

pressure being 400 volts in the town and 4000 volts in the suburbs. The method employed for changing over from one voltage to the other is noted.—Lond. *Electrician,* Oct. 20.

Street-Railway Agreement.—E. SCHIFFL.—A critical discussion of the new agreement between the city of Berlin and the Great Berlin Street Railway Company. The author thinks that this agreement is not favorable enough for the city.—*Elek. Zeit.,* Oct. 19.

Installations, Systems and Appliances.

British Municipal Station.—An abstract of last year's financial report of the Middlebrough municipal supply station, which is being operated in conjunction with a supply in bulk from the Cleveland & Durham Electric Power Company. The bulk supply was first taken in the financial year 1908-9, when the number of kw-hours generated fell to 535,729, compared with 1,855,880 in the preceding year, and the number of kw-hours purchased was 1,408,733. For the year ended March 31 last 611,407 kw-hours were generated and 1,834,115 kw-hours were purchased. Deducting the loss in conversion, distribution, etc., the number of kw-hours sold was 2,021,886, an increase of about 200,000 compared with the output of the previous year. For private lighting 892,063 kw-hours were sold and for motor service and heating 1,104,100 kw-hours, the average revenue obtained for the two supplies being 7.26 cents and 2.30 cents respectively, the average price per kw-hour received for the whole supply, after allowing for discounts, being 4.36 cents. The total cost, including capital charges, per kw-hour sold was 3.96 cents last year, against 4.92 cents in 1907; the total revenue per kw-hour sold was 4.46 cents. It will be seen that the total cost of generating the kw-hour has been reduced by nearly 1 cent since the supply in bulk was taken. As regards the generating costs, the cost for fuel for the energy actually generated by the station plant works out at 0.8 cent per kw-hour generated, while the bulk supply averaged 1.08 cents per kw-hour purchased, the energy being measured on the low-tension side.—Lond. *Electrician,* Oct. 20.

Power-Factor Correction with Synchronous Motors.—N STAHL.—An article discussing power-factor correction with synchronous motors. The author gives a number of convenient curves which enable one to shorten the rather complicated calculations on the subject. The first diagram gives curves showing the ratio of wattless component of a circuit to its kilovolt amperes and kilowatts at various power-factors. He then shows in a set of curves how the power-factor of a circuit is raised by the addition of non-inductive load. Then follow two sets of curves showing the amount of wattless component required to raise the power-factor of a given kilowatt or kilowatt-ampere load to a required higher value. Another set of curves is given for determining the maximum power-factor improvement which can be obtained with a given kilovolt-ampere original load at given power-factor and synchronous condenser of given kilovolt-ampere rating; also the mechanical load which the condenser will carry simultaneously. Then follow curves for determining the mechanical load on a synchronous condenser corresponding to required power-factor improvement and corresponding kilovolt-ampere rating of condenser, assuming the power and wattless components of the condenser load to be equal. He finally gives curves for determining the approximate excitation required by alternators at various power-factors. He shows how these curves can be applied to the solution of specific problems. *Elec. Journal,* October.

Inspection and Insurance of Electrical Machinery.—An account of last year's report of the chief engineer of the British Engine, Boiler & Electrical Insurance Company. The increase in the number of electrical machines insured compared with 1909 was 14 per cent, in breakdowns 12.8 per cent, and in the cost of breakdowns 17.6 per cent. The rates of breakdowns among the various classes of machinery were as follows: Generators, continuous-current, 1 in 16.5; alternating-current, 1 in 5.3. Motors, continuous-current, 1 in 8; alternating-current. 1 in 12. Generators and motors, continuous-current, 1 in 8.8; alternating-current, 1 in 11.2. Starters and controllers, 1 in 25.4. As to the parts which are believed to have failed first in electric motors information is given in the following table:

	Direct-Current.	Alternating-Current.
Armatures or rotors, per cent	33	30
Commutators or slip-rings	29	5
Magnet or stator coils	15	36
Brush gear or terminals	6	2
Rotating parts not carrying current	8	5
Stationary parts not carrying current	9	22
	100	100

Some typical examples of breakdowns are described. Information is also given concerning engines, boilers, etc.—Lond. *Electrician,* Oct. 20.

Danger of Fire from Gas, Electricity and Kerosene.—Statistical data collected from the official fire statistics of Prussia for 1909. The results are given in the following table, which gives the number of fires due to gas, electricity, kerosene and the careless handling of matches and states the damage done. A large number of the fires recorded under carelessness in using matches must be charged against gas-lighting:

	Number of Fires.	Damage.
Gas	1,198	$69,617
Electricity	382	404,699
Kerosene	4,765	310,226
Carelessness in using matches	10,787	1,369,495

The number of fires per lamp was eighteen times as great for gas as for electricity.—*Elek. Zeit.,* Oct. 12.

Austria-Hungary.—E. HONIGMANN.—An article giving statistical data on the electrical export trade of Austria and Hungary in the first half year of 1911.—*Elek. Zeit.,* Oct. 12.

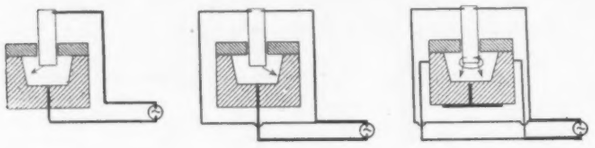
Electrophysics and Magnetism.

Magnetic Properties of Electrolytic Iron Layers Deposited in a Magnetic Field.—R. GANS.—Maurain had determined the magnetization curve of layers of iron deposited electrolytically in a magnetic field and had found that the formula of the magnetization curve was quite different from that obtained when there was no magnetic field acting during the electrolytic deposition. Kaufman and Meier have later shown that it was not the magnetic field but occluded hydrogen and the observance of certain conditions in the preparation of the solution and in the electrolysis which were the cause of the peculiar changes in the magnetization curves. By an entirely different method the present author gives the same result and shows that a strong magnetic field employed during electrolysis, while it has an influence on the instantaneous magnetic conditions of the iron, has no influence on its permanent magnetic properties.—*Phys. Zeit.,* Nov. 1.

Electrochemistry and Batteries.

Electric Steel Refining.—A. MUELLER.—A very long and detailed description of the results obtained with the Girod electric steel-refining furnace at Gutehoffnungshütte. In the Girod furnace there is a top electrode and a bottom electrode, and the way of conducting the single-phase current to the furnace is of great importance for the results. There are three methods in use, as shown in Fig. 3. In

method I the shortest path from the motor-generator set to the carbon and steel electrodes has been chosen, all of the cables being on the side of the furnace which faces the motor-generator. In method II the cable to the carbon electrode is divided into two sections which run parallel to each other. The steel electrode is connected by the shortest



I *II* *III*

Fig. 3—Diagrams of Connections.

path with the motor-generator set. Method III is the one used since August, 1910, at the Gutehoffnungshütte. The current is conducted to the carbon electrode in a manner similar to method II. But while in methods I and II the bottom steel electrode is insulated from the furnace body itself (only the metal bath being in the electric circuit), the steel electrodes are here electrically connected with the furnace body. The arrangement of the conductors is symmetrical around the furnace. With the first two methods the electric arc is deflected toward the side marked with the arrow, which results in a non-uniform heating of the steel bath and a rapid destruction of that side of the furnace which is exposed to the excessive direct heat of the arc. Method III avoids all this. Details are given of the construction of the lining, of the heat losses due to the water cooling of the electrodes, of the influence of temperature and size of furnace on the specific energy consumption, and of the metallurgical actions during the oxidation and deoxidation periods in the refining process.—*Met. and Chem. Eng'ing,* November.

Melting Ferromanganese in Electric Furnaces.—J. Bronn and W. Schemmann.—When ferromanganese is used as a deoxidizer in steel making it is usually added in the solid form. A considerable saving, as well as other advantages, is obtained if the ferromanganese is added to the steel in the molten form. To remelt ferromanganese the cupola and open hearth are unsuitable on account of the considerable loss of manganese. No such loss is experienced if the ferromanganese is melted in an electric furnace. The authors use a low-tension arc furnace with good success.—*Met. and Chem. Eng'ing,* November.

Steel-Refining Furnace.—T. D. Robertson.—An illustrated description of the Grönwall steel-refining furnace, which is operated by two-phase currents. If the supply is three-phase the Scott transformation method is used. There are two carbon electrodes at the top, each being connected to one phase. There is also a carbon block in the furnace bottom, which is connected to the neutral point. There is a vertical as well as a horizontal circulation of the metal in the bath.—*Met. and Chem. Eng'ing,* November.

Units, Measurements and Instruments.

Slipping-Contact Rectifying Detector.—L. W. Austin.—The author has formerly described (*Electrical World,* Vol. 48, page 924, 1906) a detector for electric waves in which a piece of tellurium is pressed against a rotating aluminum rod. The author has also found that any other slipping contact may be used as a detector. The best results are obtained with a highly polished copper or nickel disk which is driven by a motor and against which a piece of thin light copper wire is pressed. The only difficulty is to get a suitable surface on which the contact can slip. In many cases there is a tendency for the point to jump off, so that the signal is interrupted and the distinction between dots and dashes is rendered difficult. This difficulty has been overcome to a large extent by the introduction of high-frequency sparks. This detector is exceedingly sensitive. Its sensitiveness is from three to ten times that of electrolytic detectors for weak signals. The rationale of the detector action is probably of a quite complicated nature. There is to a certain extent a rectifying effect, but the rectification is not always in the same direction.—*Phys. Zeit.,* Oct. 15.

Telegraphy, Telephony and Signals.

Telephone Cable.—An article stating that the new telephone cable which has been laid between St. Margaret's (Kent, England) and La Panne, in Belgium, represents the greatest advance that has yet been made in the application of the Pupin coil system to telephony. The conductors are of the same size as in the earlier Anglo-French loaded cable, namely, 160 lb. per nautical mile, but instead of the dielectric weighing 300 lb. per mile it weighs only 150 lb. A special gutta-percha is used in the Anglo-Belgian cable with a particularly small leakance, and the ratio *S/K* has been reduced from 120 in the Anglo-French cable to 12 in the Anglo-Belgian cable. The two circuits in the cable, instead of being used merely for two conversations, will be able to be used for three simultaneous conversations by the use of what was formerly somewhat incorrectly called duplexing and is now usually termed a "phantom" circuit. The wires of each circuit are bridged by repeating coils, the center of each of which is connected to form the third circuit, so that the two wires of each of the "side circuits" are used in parallel for the "phantom" circuit, as has frequently been done in the case of long-distance land lines. To enable this to be possible in the case of a loaded circuit, however, it was necessary to insert an additional series of loading coils in each circuit. The two windings in the loading coil in the side circuits are placed as in the Anglo-French cable, on one core, and are, of course, so arranged that the inductive actions of the two windings assist one another. When the two conductors are used in parallel on the phantom circuit these two windings therefore neutralize one another, and another winding is necessary with a pair of coils wound both in the same direction, instead of in contrary directions, so that they act as an inductance coil when the two wires are used in parallel for the phantom circuit, but the inductances oppose one another when the two conductors are used in the ordinary way. The total length of the cable is 47.892 miles, and each wire has a length of 48.366 miles. The actual construction of the cable and the method of inserting the armoring and loading coils follow exactly the methods employed in the Anglo-French cable. Loading coils are inserted one mile apart, and the additional loading coil for the "phantom" circuit is inserted at the same place. In construction this additional loading coil is similar to the others, except that one of the windings is reversed, and it merely increases the length of the bulge by 8 in. The figures of the principal constants of the cable have already been given in the *Digest.*—Lond. *Elec. Eng'ing,* Oct. 19.

Single-Line Telephone System.—A note on a recent British patent (5734, Sept. 21, 1911) of C. H. Ellison and W. J. Thorrowgood. In a battery ringing system in which several stations are connected in series the relays of the calling bells are shunted by condensers. The calling switches are inserted between the line and the station batteries, which are connected between the line and earth. By this arrangement, while the stations are in series for telephone currents, part of the line is cut out from the ringing circuit, namely, that between the battery connection of the calling station and the end of the line away from the station which is being called.—Lond. *Elec. Eng'ing,* Sept 28.

Wireless Telegraphy.—Mosler.—In modern wireless-telegraph receiving stations using thermo-detectors the so-called non-periodic circuit is now used preferably instead of a tuned receiving circuit. The author shows that the non-periodic circuit can also be used in connection with a

sounder and that this results in considerable simplification of the arrangements and in a noteworthy increase of sensitiveness in comparison with Schloemilch cell detectors.—*Elek. Zeit.*, Oct. 12.

Miscellaneous.

Physical Laboratory.—K. R. KOCH.—A description, profusely illustrated by diagrams, of the new physical laboratory of the Institute of Technology of Stuttgart.—*Phys. Zeit.*, Oct. 1.

Mica.—A. KLUTZSCH.—The author discusses briefly the occurrence of mica in Canada, North America, Brazil, India and in the German colonies in Africa, which in time may become considerable producers of mica.—*Elek. Zeit.*, Sept. 28.

Titanium Steel.—A note on the 1910 statistics of the American Iron & Steel Association. Out of 567,819 tons of various alloy steels, not less than 326,316 tons were titanium steel.—*Met. and Chem. Eng'ing*, November.

New Apparatus and Appliances

CONVENIENT MEANS FOR DETERMINING FLUE-GAS TEMPERATURES.

Indicating and recording thermometers and pyrometers are sometimes employed for measuring the temperature of flue gases, but their use is not general owing partly to the cost and also to the fact that many types of instruments are not reliable or break down in service. There is therefore a demand for cheap and efficient means of determining flue-gas temperatures, which the Green Fuel Economizer Company, Matteawan, N. Y., has met by devising the temperature pendants shown herewith. These pendants consist of fusible alloys of the proper composition to indicate the desired temperatures. The melting points of such metals were found to be too uncertain and evasive to be used as temperature tests, and the Green Fuel Economizer Company, therefore, devised the expedient of using the tensile strength of the metal, instead of the melting point, as the true indication of temperature. The pendants are made with a large body, having a certain definite weight, suspended from a narrow neck, and the composition of the metal and cross-section of this neck are adjusted until the body of the pendant will pull the neck in two and fall at some desired temperature. In actual use the pendants are hung upon a small hook made upon the end of a long wire, which is introduced into the flue so that the pendant will be at the desired point. At present the company has perfected pendants for three temperatures, 425 deg., 500 deg. and 550 deg. Fahr., representing respectively the temperature at which the use of the economizer is justified with

Temperature Pendant.

coal at commercial prices, the temperature at which an economizer is a good investment in all cases, and the temperature at which neglect to install an economizer becomes an inexcusable waste.

DIRECT-CURRENT AUTO-CONVERTER.

Occasions frequently arise where direct current at a higher voltage has to be converted into direct current at a lower voltage, and for this purpose a motor generator has hitherto been installed. This type of machine, consisting, as it does, of two entirely separate machines, requires a comparatively large floor area, and the cost is necessarily high for the output. The machine illustrated herewith has

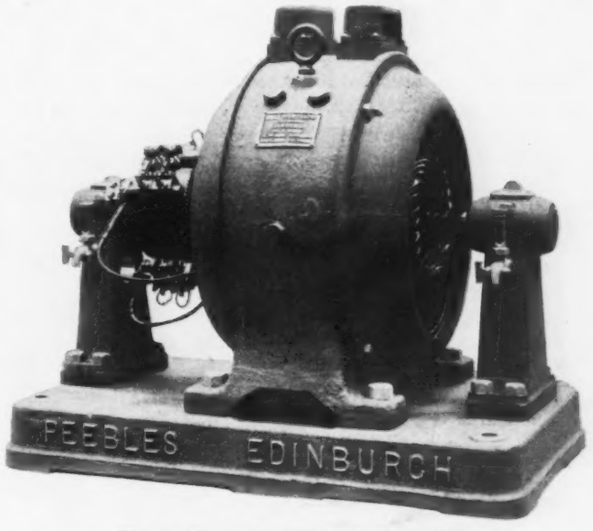


Fig. 1—Direct-Current Auto-Converter.

been developed for delivering direct current at low voltage from the same armature winding at which direct current at high voltage is received. It consists of only one machine with the usual rotating armature and commutator. It differs from the ordinary direct-current machine mainly in the arrangement of the field cores and windings. Each field pole is in two parts, which are subjected to different magnetomotive forces. Brushes are placed on the commutator not only at the neutral points between poles of unlike signs, but also at the points of division of each pole in two parts. When the voltage between the brushes at the so-called neutral points is kept constant that between the other brushes varies with the change in relative excitation of the two halves of the pole cores. There are thus two sets of brushes, one set receiving current from the source of supply and the other delivering current at a reduced or increased voltage. The two sets of brushes may be placed on a common commutator, or the machine may be provided with two commutators connected to the common armature winding, according to the amount of current and the ratio of transformation.

The machine can be designed for any ratio of transformation between the limits of 1 to 1 and 10 to 1. It is stated that its efficiency at all loads is higher by 5 per cent to 12 per cent than that of a motor generator of similar output. The performance of a 5-kw, 460-volt to 60-volt converter is shown in Fig. 2.

In addition to taking the place of an ordinary motor-generator set the machine can also be designed to convert

from constant voltage to constant current, in which form it becomes particularly suitable for projector, cinematograph and similar work. As a three-wire balancer it gives very satisfactory results, and it can also be designed to effect a double reduction in voltage, say from 500 volts to a three-wire circuit having 100 volts across the outers, in which latter case it is only necessary to introduce into the secondary circuit a suitable static balancing transformer. It is also eminently suitable for charging batteries for electric vehicles, motorboats, etc., where the pressure of supply available is too high for this purpose, the secondary pressure on the machine being easily variable by ordinary shunt regulation. It can further be arranged to charge batteries with a current which the machine will automatically keep

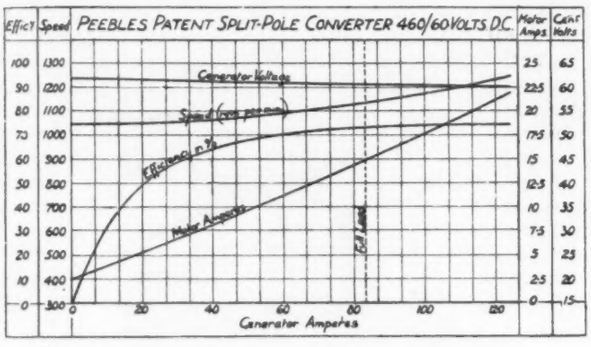


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Fig. 2—Characteristics of 5-kw Auto-Converter.

constant. One of the uses to which the machine can be put is in connection with the driving of paper-making machines, where the rolls have to be driven at varying speeds. In such cases a converter would be used to supply energy at variable voltage to, and thus to vary the speeds of, the different motors in the correct proportions up or down. The above are perhaps the most important uses of the direct-current auto-converter, although there are, of course, many other minor uses not specifically mentioned. This machine has been placed on the market by Bruce, Peebles & Company, Ltd., Edinburgh, Scotland.

HIGH-VOLTAGE TRANSFORMERS.

After a close study of the general construction and the details of the design required in transformers for high-tension service, the General Electric Company has decided that its Type "H" (core type) transformer most fully meets the requirements for high-voltage work on either self-cooled or water-cooled designs, single-phase or three-phase, in capacities up to and including 500 kva and 600 kva for outdoor and indoor service or circuits of any commercial voltage and frequency. Some of the new features of this line of transformers as designed for high-tension work are as follows:

The original method of fastening the laminations together with horn fibre channels and shellacked wooden dowel pins is superseded by the use of insulated metal rivets. The interleaving of the yoke laminations with the leg laminations is maintained, having proved superior to other forms of joints. A supporting plate furnishes additional mechanical reinforcement to the outside laminations. The clamps for the yoke laminations consist of steel angle plates. Bolts engaging with these clamps and notches cut in both the yoke and end laminations contribute to a firm engagement of the clamps and core, giving a rigid mechanical construction.

The coil supports engaging with the steel angle plates consist of treated wooden blocks providing generous bearing surface for the coils. On the higher voltage designs this wood is supplemented by wet-process porcelain parts, giving greater insulation strength without loss of mechanical strength. These supports are adjustable to correct any tendency for the parts to get out of alignment during transportation and before the transformer is put in service.

The tank for the self-cooled transformer consists of a

Fig. 1—Outdoor-Type Transformer.

corrugated steel body amalgamated with a cast-iron base and cast-iron rim. This construction, originally recommended about five years ago, is adhered to, as it gives a thoroughly satisfactory construction, being free from solder or riveted seams which may open up by sudden application of heat externally applied or by sudden sharp mechanical strains.

For the water-cooled transformers the body is of smooth cast iron, which, with the base and rim, is made in one piece. The cooling coils for these transformers have both inlet and outlet brought out at the side below the oil level

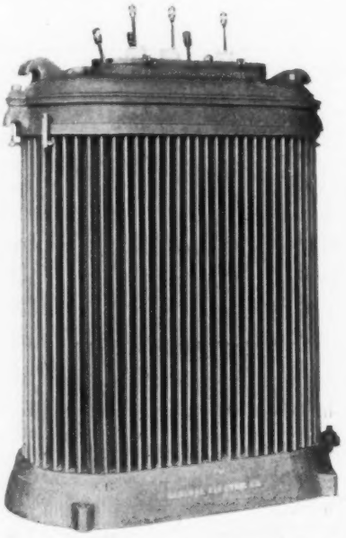


Fig. 2—Three-Phase Transformer with Flexible Leads.

so that no portion of the cooling oil is exposed to the air, effectively preventing any condensation of moisture from the atmosphere and consequent deterioration of the oil These pipes may be of copper, brass or iron, determined by the purity, etc., of the cooling water. The bases of both self-cooled and water-cooled transformers are pro-

vided with lugs to facilitate skidding, and also with smooth bottoms to facilitate handling by rollers, etc., in transportation.

By a proper distribution of the metal and in reinforcing by deep ribs such portions of the cover as are subject to strains a very light construction is made possible. Hooks of unusual strength are provided so that the transformer itself, or complete tank and oil, may safely be raised or lifted by them. Bushing plates are placed over large openings in the cover and serve as supports for wet-process porcelain bushings through which the leads enter the case. The openings provide access to the interior of the tank for change of connections and facilitate examination without the necessity of removing the transformer itself from the tank.

The development, about two years ago, of the outdoor lead and its application to these transformers have made possible a line of outdoor transformers using the same mechanical parts as the indoor type.

The cylindrical windings of core-type transformers are maintained, as having proved to be the strongest both electrically and mechanically. These coils, being separately wound and insulated, permit attention to details of insulation not possible where windings are not so manufactured. The "compounding" of the coils by the vacuum process—that is, the complete removal of all moisture and air before the impregnation with an oil-resisting insulating compound—insures a construction able to withstand the frequent strains and surges, both of normal and high frequency, daily occurring on large high-voltage systems.

A DIRECT-READING INSTRUMENT FOR MEASURING LOW RESISTANCES.

The Evershed "ducter," illustrated herewith, combines in one instrument the functions of the ammeter, the potential galvanometer and the slide rule. It gives a direct reading of the value of the resistance under test, without any more calculation than is involved in multiplying by tens. There is no preparation to be made beyond connecting the ducter to the cell which provides the testing current and pressing the contact spikes which complete the circuit against the terminals of the resistance which is to be tested. The movement is nearly aperiodic, and the index comes to rest in about three seconds from the moment when the contact spikes are applied to the test resistance. Hence the reading can be noted within four or five seconds, and a complete test will not usually occupy more than one minute from start to finish.

The ducter covers the entire range of low-resistance measurement, beginning at a few millionths of an ohm and ending at 5 ohms, a value which is well within the range of an ordinary Wheatstone bridge. By means of a five-way switch the whole range is divided into five grades, for which the scale readings must be multiplied by unity, ten, a hundred, a thousand and ten thousand respectively.

The working principle of the instrument is similar to that of an ohmmeter, and it might be described very briefly as a potential ohmmeter. As will be seen by reference to Fig. 2, the movement consists of two coils P and C fixed upon an axle with their magnetic axes at a certain definite angle to each other.

The coil P is wound as a potential coil, and being connected in parallel with the test resistance X it is traversed by a current proportional to the drop. The other coil, C, is connected across the terminals of a resistance, or shunt, in the main circuit of the battery E and in series with the test resistance. This coil therefore is traversed by a current proportional to the current flowing through the test resistance, and provides a clockwise controlling torque opposed to the deflecting torque of the potential coil. The two coils move freely in the magnetic field of a powerful permanent magnet N S, and the angular position they take up depends solely upon the ratio of the current in the potential coil to that in the control coil. In other words, the deflection of the movable system depends solely upon the ratio of the drop across the test resistance to the current flowing in it; that is to say, it is a measure of the resistance X.

Any potential instrument for the measurement of very low resistance is liable to damage by excessive current, because the potential winding is necessarily designed to work with a very small potential difference, and the actual drop across a test resistance of unknown value may be enormous by comparison. In an extreme case there may be an unsuspected break in the circuit of the resistance under test, with the result that the full pressure of the testing battery is applied to the terminals of the potential circuit. Mishaps of this kind are quite unavoidable, but in the ducter the risk of damage is entirely removed by including an automatic cut-out in the circuit of the potential coil. The cut-out, which is shown at K in Fig. 2, is of the polarized magnetic type, and the moving parts have an inertia sufficiently small to insure the opening of the potential circuit before the excessive current has imparted a dangerous velocity to the coils and index of the ducter.

The scale is 110 mms in length, divided by calibration into 50 nearly equal parts. The position of the index can be read quite easily to less than one-quarter of a division.

The ducter is compensated for temperature, and hence the scale reading gives the actual value which the test resistance has at the time the test is made, no matter what the temperature of the instrument itself may be.

In Fig. 2 the ducter is shown measuring the resistance of a metal strip X. The scale is 85, and the grade switch stands at multiplier 100, making the value 8,500 microhms or .0085 ohm. This is resistance of that part of the metal strip which lies between the potential contacts G and H.

For carrying the current to and from the resistance under test, and for making the necessary potential connections,

Fig. 1—Instrument for Measuring Low Resistances.

two twin flexible leads are provided, each having metal tabs at one end to fit the ducter terminals and terminating at the other end in an insulating handle. Projecting from each handle are two metal contact spikes of a novel kind, one to make the current connections and the other the potential contact. Each spike is a steel rod with an archime-

dean screw cut upon the inner end and arranged to screw freely in and out of the handle, the travel being limited by stops. Normally two spiral springs inside the handle force the rods to screw themselves outward against the outer stops, but when the handle is used to press the spikes into contact with the surface of any conductor the rods screw round and recede more or less into the handle, at the same time compressing the spiral springs. In this way each spike is independently forced by its spring into contact with the conductor, no matter how irregular the conductor surface may be or at what angle the handle may be held. The contact end of each rod is a pyramid or square point, and the rotary motion imparted to it by the archimedean screw insures good contact even on a dirty or oxidized surface.

The testing current is provided by a small portable battery of four secondary cells contained in a substantial teak case and provided with a switch for coupling the cells either all in parallel to give 2 volts or all in series to give 8 volts.

The readings of the ducter are very nearly independent of the strength of the testing current, which may vary within wide limits without causing any appreciable error.

The Evershed ducter is being placed on the American market by James G. Biddle, 1211 Arch Street, Philadelphia.

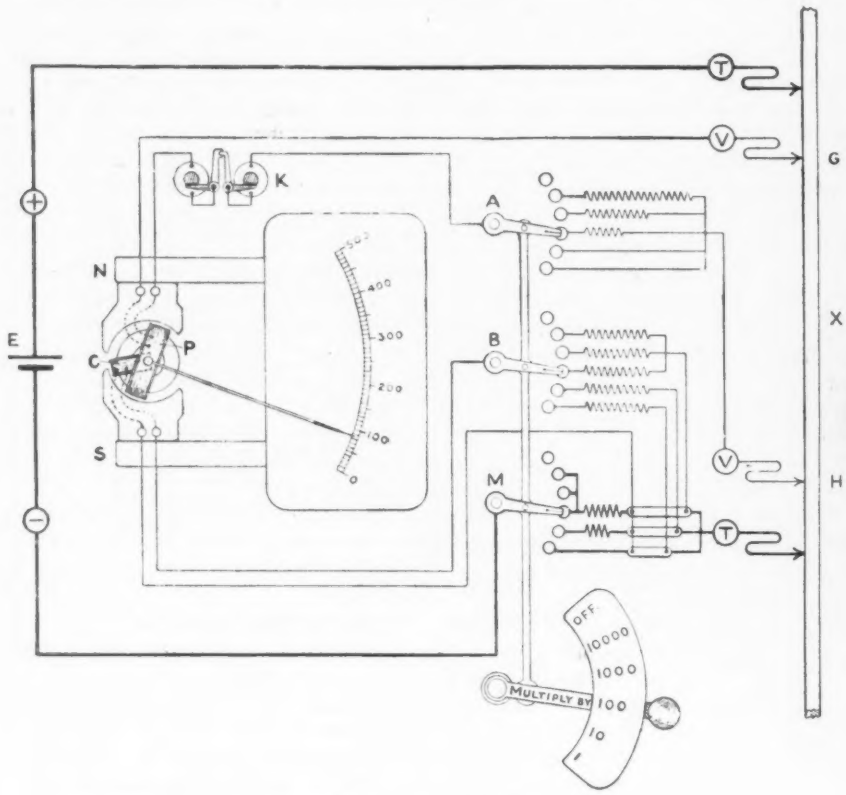
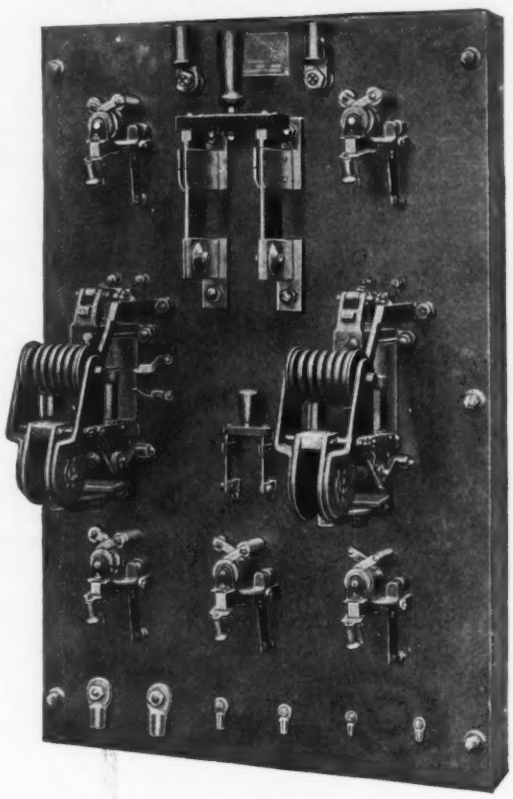


Fig. 2—Diagram of Connections.



Crane Panel.

CRANE PANELS.

In the crane cabs of electrically operated cranes having three, four or five motors the knife-switches, fuses, circuit-breakers, etc., are mounted in various locations. The arrangement cannot always be the best, and renewing cartridge fuses is both costly and inconvenient. These conditions have brought about the need for a crane switchboard panel, one of which, manufactured by the Cutler-Hammer Manufacturing Company, of Milwaukee, is shown in the accompanying illustration. This particular panel, which is designed for a three-motor crane, combines all necessary switches, protective devices, etc., giving protection against overload, short-circuit and failure of voltage. A panel of this kind reduces the amount of wiring in the crane cab, makes installation easy and eliminates the cost, inconvenience and time required in renewing fuses.

The two single-pole, magnetically operated switches (standard contactor mill type), one in each side of the main line, and the over-load devices are the principal objects on the panel. The contactor switches have copper and carbon auxiliary arcing contacts and blowouts and laminated copper brushes for carrying the current. Two single-pole switches are used because of several advantages over the double-pole type. If a double-pole switch should stick the circuit would not be opened, whereas if either single-pole switch sticks the other will open the circuit. Also if the overload remains on the line the one switch will be tripped as soon as the other is closed, which prevents quick successive opening and closing, or what is known as "telegraphing."

The small knife-switch handles the control circuit for the above switches and provision is made so that any number of these safety switches can be used (connected in series) installed in various convenient locations so that the operator can, from any of the points, open the magnetic-switch circuits, which in turn open the feeds to all motors on the crane. This safety feature prevents any accidental starting of the motors when inspection or repairs are being made.

There are two main over-loads and three motor-feed over-load devices, one for each motor on the crane. These are of special construction, having a vertical break and a wiping contact. They are accurately calibrated and can be adjusted without the use of an ammeter.

With the main-line switch and all safety switches closed, the operator throws a "reset master" (which is provided) to position 1, which closes one of the magnetic switches and establishes the feed to the second switch, while throwing the master to position 2 closes this second switch.

On grounded circuit two over-load devices for each motor on the crane are sometimes provided, and in some locations inclosing cases are desired. These cases can be provided with means for operating the main knife-switch without opening the case.

Industrial and Commercial News

THE WEEK IN TRADE.

THERE has been but little change in trade conditions in the past few days, and such improvement as has been made has been more noticeable in sentiment than in actual increase in the volume of business. The agitation that followed announcement of the federal suit against the United States Steel Corporation has subsided for the present, and recovery from the shock has been made in the stock markets and in general trade. Cooler weather has been responsible for a large proportion of the better tone prevailing in business circles, and sales of seasonable apparel and necessities have benefited retail and jobbing houses. Very little change has taken place in the cotton markets, owing to uncertainty of prices, and purchases are still confined to small lots. Stocks of goods of all descriptions are thought to be well below normal, and on this account the mild buying movement of the week gives promise of continuation. Equipment orders placed by the railroads during the week have been decidedly encouraging. The extensive car buying of the past few weeks has been followed by substantial increases in the number and size of rail orders and inquiries. Rail orders aggregating 100,000 tons are said to be pending. The pig-iron market is becoming quieter, and few contracts are being placed for first-quarter delivery. Opinions differ upon the immediate cause of hesitation in trade advancement, but there seems to be a general tendency at this time to wait a little longer and see what happens, rather than to take the initiative in business commitments. Business failures for the week ended November 2, as reported by *Bradstreet's*, were 200, as compared with 231 in the previous week, 179 in the corresponding week in 1910, 212 in 1909, 205 in 1908, and 226 in 1907.

The United States Circuit Court has approved the plan for reorganization of the American Tobacco Company. The plan as accepted does not include the proposal of Attorney-General Wickersham for a five-year probation period under federal supervision, nor does it carry out the wishes of the independent companies as regards stock control; but it is regarded as meeting the requirements of the Sherman law. It does not force the American Tobacco Company into a receivership, and this is regarded as a most favorable outcome of the case, since there is every reason to believe that the Supreme Court in rendering its decision wished to destroy only the method of doing business.

THE COPPER MARKET.

CONTRARY to general expectation, the October report of the Copper Producers' Association, issued on Wednesday, showed a decrease of 5,897,214 lb. in surplus copper stocks instead of the increase which most of the trade believed would be shown. In view of this result, the report as a whole is regarded as decidedly more favorable than the reports for several months past. Production was 118,225,442 lb., as against 115,588,950 in September, which with the surplus stocks at the beginning of the month made a total of 259,150,298 lb. of copper to be accounted for in October. Domestic deliveries were 64,068,307 lb., as against 57,311,584 lb. in the previous month, and exports were 60,084,349 lb., as against 50,824,011 lb. in September, making total deliveries of 124,152,656 lb. as compared with 108,135,595 lb. in the month before.

Standard Copper.	Bid.	Asked.	Settling Price.
Spot	12.00	12.25	.....
November	12.02½	12.15	12.10
December	12.07½	12.15	12.12½
January	12.10	12.15	12.12½
February	12.15	12.20	12.17½

The London market, Nov. 8, was as follows:

	Noon. £ s d	Closing. £ s d
Standard copper, spot	56 1 3	56 2 6
Standard copper, futures	56 15 0	56 17 6

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	12.35c	11.57½c
London, spot	£57 10 0	£53 7 6
London, futures	58 2 6	54 0 0
Best selected	61 10 0	57 5 0

This left stocks on hand of 134,997,642 lb., or, as given above, 5,897,214 lb. under the September surplus. The increase in domestic consumption, 7,000,000 lb. in excess of the September figure, was a surprising feature of the report, the deliveries into domestic hands being the largest since June. The gain in production, about 3,000,000 lb., is attributed to the extra day in October as compared with the preceding month, and this increase is offset by the gain in deliveries. The average daily deliveries to domestic consumers were 2,647,365 lb., as compared with 1,910,386 lb. in September. The average daily exports were 1,937,044 lb. Business has been very slack pending issuance of the report, consumers waiting to learn the results for the month and their influence on the price situation before committing themselves. There has been an effort made during the week to advance the price of electrolytic, and there were reports early in the week that the leading interests had advanced their price to 12⅝ cents. Most of the agencies have been willing to close contracts at 12.37½ cents. Second hands have been offering copper at concessions from these prices, but there has been very little interest taken in the market. Exports for the month including Nov. 8 aggregate 6,699 tons. The daily call on the Metal Exchange Nov. 8 quoted copper as per the accompanying table.

INDUSTRIAL AND COMMERCIAL NOTES.

Republic Railway & Light Company.—Through its subsidiaries, the Republic Railway & Light Company, 60 Broadway, New York City, now owns and operates about 150 miles of electric railway lines, three electric-lighting stations, and three gas plants, with which it is serving the rapidly growing industrial section in the valleys of the Mahoning and Shenango Rivers. In this territory, embracing an area of some 300 sq. miles, are Youngstown, Ohio, and Sharon and New Castle, Pa., the total population being close to 200,000. Since its incorporation, on June 28, 1911, in New Jersey with a capital of $17,500,000, as mentioned in these columns July 1, the Republic Railway & Light Company has been making rapid progress in improving its properties. A new 4000-kw turbine is being installed in the station at Youngstown, the line to Idora Park, outside of Youngstown, has just been double-tracked, and a new fireproof substation of 1500-kw capacity has been completed at Niles, Ohio, where new carhouses are being erected. Various additions to the railway system in Sharon, Youngstown and New Castle are contemplated, and the transformation of cars to the prepayment type is also under consideration. Gross earnings of the subsidiary companies for the month of September were $196,875, a gain of 8.93 per cent as compared with those in September, 1910. Operating expenses and taxes were $106,208, an increase of 2.42 per cent, leaving net earnings of $90,667, which represents a gain of 17.68 per cent over returns in September, 1910. In the nine months ended Sept. 30, 1911, gross earnings were $1,705,105, as compared with $1,623,172 in the corresponding period last year, a gain of 5.05 per cent. Operating expenses and taxes were $975,839, as against $945,118, an increase of 3.25 per cent, and net earnings for the period were $729,266, as compared with $678,054, or a gain of 7.55 per cent for nine months of operation in 1911. Regular dividends of 6 per cent per annum are being paid on the $10,000,000 preferred stock. The company has no bonded indebtedness, and the subsidiaries have outstanding bonds amounting to $10,148,100. All Pennsylvania franchises of the company are perpetual. In Ohio the city franchises of Youngstown were recently renewed for twenty-five years, the legal maximum. The interurban franchises expire at various periods from 1945 to 1950.

Accidents on Electric Lines.—Accident Bulletin No. 40, just issued by the Interstate Commerce Commission, shows that the total number of railroad casualties of all classes for the year ended June 30, 1911, was 160,555. Of these 10,396 were fatal. During the year, as shown by accident reports, on electric lines carrying interstate traffic there were 410 persons killed and 3264 injured.

Livingston-Niagara Power Company.—At a meeting of stockholders of the Livingston-Niagara Power Company held at its incorporating office in Caledonia, N. Y., on Oct. 13, the following officers were elected: President, Merton E. Lewis; first vice-president and general manager, Quincy W. Hershey; second vice-president, Charles J. Brown; secretary, Henry G. Strong; treasurer, Henry C. Brewster; assistant secretary, Donald M. Lewis. Directors were elected for the ensuing year as follows: Merton E. Lewis, William W. Dake, Henry C. Brewster, Charles J. Brown, Quincy W. Hershey, Henry G. Strong and William C. Likly. Reports were submitted to the board of directors showing the progress of construction of a 2000-hp receiving station at Golah, N. Y., and transmission lines from Golah to the villages of Avon, Livonia, Lima, South Lima and Honeoye Falls. Niagara energy will be distributed in these villages, and numerous industrial concerns, taking advantage of the continuous service, are planning to install electric motors for the operation of their plants. The company is now planning additional transmission-line construction and hopes to furnish service for several other villages in the same locality in the near future. R. E. Bowen is the engineer for the company and W. W. Crocheron is superintendent of construction.

Marconi Wireless Company Buys Lodge, Murihead Patents.—Control of the Lodge, Muirhead Syndicate's patents applying to wireless telegraphy has been purchased by the Marconi Wireless Telegraph Company, Ltd., thus settling the patent differences that have existed between these companies. John Bottomley, vice-president of the Marconi company, said this week that Sir Oliver Lodge will be associated with the Marconi company as scientific adviser, and that his broad experience in wireless telegraphy will be exceedingly valuable to the Marconi interests. Mr. Bottomley stated further that suit has been brought by the Marconi Wireless Telegraph Company, Ltd., against Siemens Brothers & Company, Ltd., the former company claiming that the system of the latter is an infringement of Marconi patent rights. The Vaniman airship, which will be used shortly in an attempt to cross the Atlantic, is equipped with a Marconi outfit designed especially for this service. It has a range of 500 miles and is installed in a lifeboat suspended from the body of the airship.

Manufacturers and Distributors of Rollinson Electrical Specialties Consolidate.—The Mohawk Electric Company, manufacturers of the Rollinson electrical specialties, formerly of Albany, N. Y., and the St. John Corporation, of 180 Broadway, New York City, general distributors of these products, have united under the name of the Mohawk Electric Company. The new company has been incorporated under the laws of New York and its officers and directors are as follows: G. St. John, Jr., president; E. H. Rollinson, vice-president; A. W. Hogeland, treasurer; M. L. Rollinson, recording secretary, and B. F. La Rue, financial secretary. After Dec. 1 the main office of the company will be at 64-66 Shipman Street, Newark, N. J., where its new factory is located. This building has twice the floor space of the old Albany plant, which has been shut down. Lamp-testing watt indicators, rectifying sets for charging storage batteries from alternating current, and toy transformers are among the specialties manufactured by the company.

Chicago Traction Merger.—The following plan of procedure, it is stated, has been agreed upon as a result of a conference between a sub-committee of the transportation committee of the City Council and representatives of the interests concerned with the proposed traction merger in Chicago: A commission of experts is to be selected by the city to value elevated properties, the basis of valuation to be agreed on between the committee and the elevated companies; a tentative unification ordinance is to be drafted by the railway companies with a representative of the city's legal department for submission to the general committee; all subway plans will be submitted to the general committee and the subway commission; a series of public hearings is to be held by the general committee for discussion of all questions.

Kings County (N. Y.) Electric Light & Power Company.—Following a directors' meeting on Nov. 6, an official of the Kings County Electric Light & Power Company said: "October has shown the largest gains of any month in 1911 over the corresponding month of a year ago. The gain in volume of business and gross revenue has approximated 16 per cent. Expenses have not yet been compiled and the full monthly statement will be given out Nov. 20. At last the company has got away from the Coney Island comparison, which has been unfavorable on account of the Dreamland fire." The regular quarterly dividend of 2 per cent was declared on the capital stock, payable on Dec. 1 to stockholders of record Nov. 20. H. P. Erwin was elected secretary of the Kings County Electric Light & Power Company.

New York Traction Companies.—Summaries of the reports of earnings of the various traction companies in New York City for the year ended June 30, 1911, issued by the Public Service Commission for the First District of New York show decided increase in both subway and surface travel. Including all tunnels, elevated and surface lines in Greater New York, the total number of passengers carried was 1,617,182,963, an increase of 73,620,813 as compared with the showing in the preceding year. Total operating revenue of all the companies was $84,424,435, which is an increase of $4,216,332. Only four of the smaller companies showed decreases, as compared with ten in the previous year.

Telephone Train Dispatching Extended.—The Louisville & Nashville Railroad recently placed an additional order with the Western Electric Company for forty-two selectors to dispatch its trains over a new line to run from Lexington, Ky., to Quicksand, Ky. The purchasers are now operating over 2200 miles of circuits by the telephone. The new line now being built will cover a total distance of 96 miles, and the dispatcher for it will be located at Lexington. A message circuit will parallel the train circuit on this line and will be equipped with the same number of stations.

Diesel Oil-Engines.—The Wellman, Seaver, Morgan Company, of Cleveland, Ohio, has ordered two 225-hp engines from Busch-Sulzer Brothers-Diesel Engine Company for direct connection to direct-current generators. One of these sets is to be installed in the pontoon crane being built by the purchasers for the United States Navy at the Boston navy yard, and the other is for the Pearl Harbor navy yard, Hawaii. Contracts have also been placed for two 225-hp Diesel engines and generators to be installed in the municipal electric-light plant at Thief River Falls, Minn.

Brooklyn Rapid Transit Company.—Protest against the increase of the special franchise tax assessment by the State Board of Tax Commissioners from $51,350,400 to $55,810,100, thus increasing the tax by $47,473, has been made by the Brooklyn Rapid Transit Company. The protest is on the grounds that the assessment is based on over-valuation and is excessive. Similar protest has been entered against the increased assessment of the Brooklyn Union Elevated from $19,619,000 to $25,406,800.

Salisbury & Spencer Railway Company.—Controlling interest in the Salisbury & Spencer Railway Company, which operates between Salisbury and Spencer, N. C., has been secured by Coler & Company, of New York City, through Bird S. Coler, who is president of the North Carolina Public Service Company, of Greensboro, N. C. In addition to its railway business, the Salisbury & Spencer Company operates a gas plant at Salisbury and also does electric lighting.

Boston Elevated Company.—At the annual meeting of the Boston Elevated Railway Company it was voted to increase the number of directors from ten to twelve. The following directors were re-elected: Frank Ayer, John J. Bright, Francis E. Peabody, James L. Richards, Robert Windsor, William A. Bancroft, Samuel Carr, James M. Prendergast, and William S. Spaulding. Charles P. Hall, George P. Gardner and Eugene V. R. Thayer were added to the board.

London Traction Merger Effected.—Amalgamation of London's electric tubes and railroads and the London General Omnibus Company, which controls London street traffic, is said to have been completed. The combined capital of the companies involved is in the neighborhood of $165,000,000. The railroads were reorganized largely through the efforts of the late Charles T. Yerkes, and much American capital is represented in them.

Allis-Chalmers Company.—The annual meeting of the Allis-Chalmers Company will be held some time in April, instead of in the early part of November as originally scheduled. This change is due to the change in the fiscal year of the company from June 30 to Dec. 31.

Financial.

THE WEEK IN WALL STREET.

SINCE the filing of the federal suit against the United States Steel Corporation prices in the stock market have been irregular, but have shown a general tendency to improve. Stocks rose in price in Monday's market under the leadership of Steel common, Reading and Union Pacific, and the tone was distinctly optimistic throughout the day. The feeling was broadened in a very large measure by the increasing interest shown in the market by the outside element. Commission houses are finding that business from this source is on a somewhat better scale than it has been in recent weeks, but a very cautious sentiment is still apparent. Following the general holiday on Tuesday, the market on Wednesday failed to maintain the standard of the preceding week, and a general decline in prices took place, with the Steel shares leading under heavy selling pressure. Much of the reaction of the day was explained by election results, but many of the traders expressed the belief that the period of high prices had run its course. A mild rallying tendency was shown in the later trading, but this was not of sufficient strength to recover the losses in the earlier part of the day. Very little attention was given to the news of the day, and this lack of interest was reflected by the trend of the market. Settlement of the Moroccan controversy had no apparent effect upon either the foreign or the local exchanges, and the latter took little interest in the favorable copper statistics or the government's semi-monthly estimate of cotton ginned from the crop of 1911 or in the estimate on the corn crop. An increase of 17,000,000 bushels over the October corn estimate was predicted, and the cotton report placed the number of bales of cotton ginned as of Nov. 8 at 9,968,000, which represents some 1,750,000 bales in excess of the best previous showing. Low prices in the bond market are attracting a fair amount of attention from conservative investors. Continuation of large loans to foreign interests indicates the present dullness in general business and the money market. Rates Nov. 8 were: Call, 2¼@2½ per cent; ninety days, 3½@3¾ per cent. The quotations in the tables are those at the close Nov. 8.

NEW YORK.

	Oct. 31.	Nov. 8.	Shares Sold.		Oct. 31.	Nov. 8.	Shares Sold.
All. Ch.....	3*	3⅛*	700	Int. Met., pf.	42½*	45½	5,450
All. Ch. pf..	10½*	11	900	Mackay Cos..	85	85*	300
Amal. Cop...	52¼	54½	74,650	Mackay C.,pf.	72½*	73*	100
Am. D. T....	33⅛*	33⅛*	———	Man. Elev...	134⅛	136*	300
Am. Loco...	32⅞	33	2,500	Met. St. Ry.	15*	15*	———
Am. Loco. pf.	103*	102⅛	400	N.Y.&N.J.Tel.	139½*	139½*	———
Am. Tel. & C.	78*	78*	———	Steel, com...	54⅞	58½	1,125,585
Am. T. & T..	135	138¼	8,452	Steel, pfd....	105⅝	107¼	42,100
B. R. T.....	74¾	77⅛	15,400	W. U. T....	78½	78½	3,870
Gen. Elec....	148¾	151½	2,350	West'h, com.	63	65⅜*	6,620
Int. Met.....	14¾	14½	7,000	West'h, pfd.	115*	115*	———

PHILADELPHIA.

	Oct. 31.	Nov. 8.		Oct. 31.	Nov. 8.
Am. Rys.....	44*	44	Phila. R. T.....	22⅞	23⅜
El. Co. of A.....	11⅞	12	Phila. Elec.....	16⅛	16½
Elec. St. Bt'y.....	52	52⅞	Phila. Trac.....	83⅞*	84⅜
Elec. St. Bt'y. pf...	30*	30*	Union Trac.....	50¾	51¼

CHICAGO.

	Oct. 31.	Nov. 8.		Oct. 31.	Nov. 8.
Chi. City Ry.....	186*	186*	Com. Edison.....	131	132
Chi. Elev. Rys.....	27*	29*	Chi. Subway.....	1	1
Chi. Elev. Rys., pf...	92	92¼	Chi. Telephone.....	121*	122*
Chi. Rs., Ser. 1....	96½*	98	Nat'l Car.....	104*	104*
Chi. Rs. Ser. 2....	30¼	34	Nat'l Car, pf.....	119*	119*

BOSTON.

	Oct. 31.	Nov. 8.		Oct. 31.	Nov. 8
Am. T. & T.....	135	138	Mex. Tel.....	3½*	3
Cum. Tel.....	150½*	155	Mex. Tel., pf.....	6¼*	6
Edison	292	292*	N. E. Tel.....	144½	145½
Gen. Elec.....	147¼	152⅛	W. T. & T.....	26¾	27½
Mass. E. Ry.....	21	22	W. T. & T., pf.....	105	107¼
Mass. E. Ry., pf....	93¾	94			

*Last price quoted.
Shares sold for the week Oct. 30 to Nov. 4.

FINANCIAL NOTES.

Virginia Railway & Power Company's Annual Report.—The second annual report of the Virginia Railway & Power Company, covering operations for the year ended June 30, 1911, has been issued and shows a profit and loss surplus of $579,448, as compared with $297,369 in the preceding fiscal year. Gross earnings were $2,244,589, as against $2,058,606 in 1910, and miscellaneous income was $46,296, as compared with $33,161, these additions making total incomes of $2,290,885 and $2,091,767 respectively. Operating expenses, including taxes and depreciation, were $1,284,980, leaving a balance of $1,005,905, as compared with $1,068,037 in 1910. Charges were $407,655, as compared with $698,319 in 1910, and the surplus was $508,250, as compared with $369,718 in the preceding fiscal year. Preferred dividends were $228,652, as compared with $66,693, leaving a surplus of $279,598 for the year, as compared with $303,025 in 1910. This added to the previous surplus, $297,369, made a total surplus of $576,967, as compared with $303,025 in the preceding fiscal year. Other charges, made up of discount on sale of preferred stock and bonds, premium on bonds purchased by trustees for sinking funds, and miscellaneous charges, amounted to $51,497. Against this was a credit of $53,979 from adjustment of sinking fund instalments of underlying companies, and miscellaneous credit, making a net credit of $2,482, which was added to the surplus, as against a debit of $5,656 in the preceding year. This addition made a profit and loss surplus for the year of $579,448, as compared with $297,369 in the fiscal year ended June 30, 1910, as stated above. The general balance sheet as of June 30, 1911, showed as follows:—Assets: Property, plant, franchises and privileges, $20,674,313; new construction and betterments, $629,080; work in progress, $365,938; investments, $305,398; cash, $636,377; consumers' accounts receivable, $27,985; sundry accounts receivable, $99,080; notes receivable, $3,266; material and supplies, $179,017; prepaid accounts, $3,880; interest earned, $4,790; deferred charges, $394,021; trustees' account, $1,217,421; total, $24,541,470. Liabilities: Common stock, $7,450,500; preferred stock, $4,700,000; bonds, $11,016,626; pay rolls and accounts payable, $111,719; dividends unpaid, $117,511; matured interest on bonds, $279,950; consumers' and employees' deposits, $9,352; unredeemed tickets, $2,576; sale of property, $55,219; accrued interest, taxes and rentals, $78,162; reserve for injuries and damages, $15,405; reserve for depreciation, $125,000; profit and loss surplus, $579,448; total, $24,541,470. The kilowatt-hours output for the fiscal year ended June 30, 1911, was 16,617,098, as compared with 15,880,205 in the preceding year, and the number of customers at the end of the fiscal year was 6173, as compared with 4984. The number of street arc lamps decreased from 1227, as of June 30, 1910, to 398 on June 30, 1911, and this decrease was due to the completion and operation of a municipal lighting plant in Richmond, Va. There were thirteen street incandescent lamps at the end of the fiscal year as compared with six at the end of the previous year. The total connected load as of June 30, 1911, was 20,501 kw, as against 18,486 as of June 30, 1910.

Central Colorado Power Company.—The condensed balance sheet of the Central Colorado Power Company, of Denver, Col., as of June 30, 1911, shows as follows:—Assets: Plant and property account, $34,136,676; securities of other corporations, $50,000; cash in banks, $24,331; accounts receivable, $384,962; material and supplies, $26,006; prepaid and suspense accounts, $4,073; first-mortgage bonds in treasury, $135,000; second-mortgage bonds in treasury, $43,050; total, $34,804,099. Liabilities: Preferred stock, $7,500,000; common, $15,000,000; first-mortgage 5 per cent bonds due Dec. 1, 1946, $10,635,000; second-mortgage 5 per cent bonds, due Nov. 1, 1929, $1,350,000; accounts payable, $228,508; bond interest payable, $29,067; customers' advances payable in power, $24,042; rebate and bad debt reserve, $6,162; maintenance and operation reserve, $7,120; surplus, $24,109; total, $34,804,099. The combined statement of earnings and expenses of the Central Colorado Power Company and the Leadville (Col.) Light & Power Company, all of whose capital stock is owned by the first-named company, for the twelve months ended June 30, 1911, shows gross earnings of $424,979, as compared with $265,393 in the corresponding period of the previous year; operating expenses of $234,994, as compared with $168,585, and net earnings of $189,984, as compared with $96,807 for the twelve months ended June 30, 1910. G. H. Walbridge, 24 Broad Street, New York City, president of the Central Colorado Power Company, says that the status of property is highly satisfactory.

New Hampshire Water & Electric Power Company.—The authorized capital stock of the New Hampshire Water & Electric Power Company has been increased from $100,000 to $200,000.

Carolina Power & Light Company.—Boston interests are offering at 92½ and interest a block of the first-mortgage 5 per cent bonds of the Carolina Power & Light Company, of Raleigh, N. C., due Aug. 1, 1938. This company operates the street-railway, gas, electric-light and power service in Raleigh, the gas service in Durham, the light and power service in Sanford, Henderson and Jonesboro, and furnishes light and power service for manufacturing purposes in Fayetteville. The company is owned and operated by the Electric Bond & Share Company, New York City. Its capitalization consists of an authorized issue of $2,500,000 6 per cent cumulative preferred stock, of which $286,200 has been issued; $5,000,000 common stock, of which $4,350,000 has been issued; $5,000,000 first-mortgage 5 per cent gold bonds, of which $1,290,500 has been issued, and $273,500 ten-year 5 per cent convertible gold notes. There are $119,600 preferred stock and $202,500 gold notes outstanding, the balance being in the treasury. Gross earnings of the company in the twelve months ended Sept. 30, 1911, were $347,467, and net earnings, after deduction of operating expenses and taxes, were $127,021. The company has a hydroelectric plant at Buckhorn Falls, on the Cape Fear River, with an installed capacity of 3300 hp; a hydroelectric plant, held under indefinite lease, on the Neuse River, near Raleigh, rated at 530 hp; steam auxiliary plant at Raleigh, 5000 hp in capacity, and at Henderson, 300 hp in capacity; three substations, with an aggregate capacity of 7400 hp, and modern gas plants and distributing systems in Raleigh and Durham. It has 77.2 miles of high-tension transmission lines, and a street-railway system in Raleigh. The Carolina Power & Light Company controls all the outstanding capital stock of the Yadkin River Power Company. The latter company, as previously mentioned in these columns, has under construction a hydroelectric development on the Yadkin River, near Rockingham, N. C., which is to have an initial capacity of 32,000 hp and will, it is expected, be completed before April 1, 1912. The transmission lines are to be connected with those of the Carolina Power & Light Company and the Southern Power Company. The electric and gas lighting franchises of the Carolina Power & Light Company in Raleigh are without time limit, and that for the street railway extends to 1945.

American Light & Traction Company's Report Shows Improvement.—The statement of the American Light & Traction Company for the twelve months ended Sept. 30, 1911, shows gross earnings of $4,105,097, as compared with $3,692,475 in the corresponding period of the previous year. Expenses were $114,133, as compared with $116,495, and net earnings were $3,990,964, as compared with $3,575,980 in 1910, making, with the previous surplus of $6,444,253, a total surplus of $10,435,218, as compared with $9,198,662. Total dividends were $3,003,047, as compared with $2,754,409, and the profit and loss surplus was $7,432,171, which compared with $6,444,253 in the twelve months ended Sept. 30, 1910. The general balance sheet as of Sept. 30, 1911, shows as follows: Assets: Investment account, $27,701,394; temporary investment, $2,404,200; treasury stock (38,515 shares of common), $1; earnings of subsidiary companies, $5,406,077; bills receivable, $531,572; certificates of indebtedness, $602,899; accounts receivable, $77,511; manager's stock contracts, $163,600; interest and dividends receivable, $32,094; cash and call loans, $1,605,421; total, $38,524,774. Liabilities: Preferred stock, $14,236,200; common stock, $15,000,000; warrants, $21,022; deposits on manager's stock contracts, $18,299; taxes and expenses anticipated, $3,888; accounts payable, $53,114; miscellaneous, $7,527; dividends accrued, $770,968; contingent fund, $981,582; profit and loss surplus, $7,432,171; total, $38,524,774.

Fort Smith Light & Traction Company Preferred Stock Offered.—Chicago interests are offering 7 per cent cumulative preferred stock of the Fort Smith Light & Traction Company, of Fort Smith, Ark. This stock is part of an authorized issue of $5,000,000, of which $1,120,000 was outstanding on Sept. 30. The company has also bonds outstanding to the amount of $2,407,000 and common stock to the amount of $950,000 out of authorized issues of $6,000,000 and $1,500,000, respectively. For the year ended Sept. 30, 1911, the gross earnings of the company were $520,226, and the net earnings $222,846. After paying bond interest there remained $105,645 surplus, from which dividends on preferred stock amounting to $60,273 were paid. A majority of the stock of the company is owned by the Standard Gas & Electric Company, which is under the management of H. M. Byllesby & Company. The company owns the street-railway property in Fort Smith, as well as the electric-service and gas-distribution systems in Fort Smith and Van Buren. It has fifty-year franchises granted in 1905. On July 1, 1911, the company had 2679 electric customers and supplied energy for 226 stationary motors, aggregating 1454 hp, as well as 310 street-lighting arc lamps. The company receives $55 a year for each street lamp, and its contract for public lighting runs for six years.

Northern Ohio Traction & Light Company.—The statement of the Northern Ohio Traction & Light Company for September shows gross earnings of $246,015, an increase of $21,113 as compared with those in the corresponding month of the previous year. Operating expenses and taxes were $128,812, an increase of $10,955, and net earnings were $117,202, an increase of $10,158. Interest charges were $44,320, an increase of $929, leaving a surplus for the month of $72,882, or $9,229 larger than that in September, 1910. In the nine months ended Sept. 30, 1911, gross earnings were $2,019,746, an increase of $182,340 over the corresponding nine months in 1910. Operating expenses and taxes were $1,110,504, an increase of $100,646, and net earnings were $909,241, a gain of $81,694. Interest charges were $399,069, an increase of $8,908. The surplus for the period was $510,172, an increase of $72,785 over that in the nine months ended Sept. 30, 1910.

El Paso Electric Company's Bonds.—First-mortgage collateral trust bonds of the El Paso Electric Company, of El Paso, Tex., are being offered by Boston interests at 99 and interest. The company operates a street-railway, electric-light and power business in El Paso and vicinity, serving a population of about 55,000. Its outstanding $1,000,000 first-mortgage collateral-trust 5 per cent bonds are a closed mortgage issue. They are followed by $500,000 6 per cent debentures, $1,000,000 6 per cent preferred stock and $1,000,000 common stock paying 5 per cent. Gross earnings of the company for the year ended Aug. 31, 1911, were $671,628.27. Operating expenses and taxes were $405,303.79, and net earnings were $266,324.48. Bond interest amounted to $50,000, leaving a balance of $216,324.48.

Massachusetts Electric Companies Earnings Increase.—Gross earnings of the Massachusetts Electric Companies in October show an increase of $10,200 as compared with those in October, 1910, which compares with an increase of $50,000 in September and a decrease of $11,000 in August, 1911.

DIVIDENDS.

American Telegraph & Cable Company, quarterly, 1¼ per cent, payable Dec. 1.

Federal Light & Traction Company, quarterly, preferred, 1½ per cent, payable Dec. 1.

Federal Utilities, Inc., quarterly, preferred, 1½ per cent, payable Dec. 1.

Kings County (N. Y.) Electric Light & Power Company, quarterly, 2 per cent, payable Dec. 1.

Mobile Electric Company, quarterly, preferred, 1¾ per cent, payable Nov. 15.

Pacific Gas & Electric Company, quarterly, preferred, $1.50 per share, payable Nov. 15.

United States Steel Corporation, quarterly, preferred, 1¾ per cent, payable Nov. 20.

REPORTS OF EARNINGS.

AMERICAN LIGHT & TRACTION COMPANY.

Period.			Gross Earnings.	Operating Expenses.	Net Earnings.	Fixed Charges.	Net Surplus.
12m.,	Sept.,	'11	$4,105,097	$114,133	$3,990,964	.....	.....
12m.,	Sept.,	'10	3,692,475	116,495	3,575,980	.....	.....

DETROIT UNITED RAILWAY COMPANY.

Sept.,		1911	$912,321	$595,253	$333,942	$177,196	$156,746
Sept.,		1910	846,298	540,052	317,390	178,802	138,588
9m.,	Sept.,	'11	7,627,491	4,887,243	2,871,061	1,588,690	1,282,371
9m.,	Sept.,	'10	7,027,978	4,485,425	2,655,761	1,511,120	1,144,640

LAKE SHORE ELECTRIC RAILWAY COMPANY.

Sept.,	1911	$124,767	$62,608	$62,159	$34,713	$27,446
Sept.,	1910	115,009	54,416	60,592	34,928	25,664

NORTHERN OHIO TRACTION & LIGHT COMPANY.

Sept.,	1911	$246,015	$128,812	$117,202	$44,320	$72,882
Sept.,	1910	224,902	117,857	107,044	43,391	63,653

REPUBLIC RAILWAY & LIGHT COMPANY.

Sept.,	1911	$196,875	$106,208	$90,666	.....	.....
Sept.,	1910	180,740	103,696	77,044	.....	.....

General News

Construction News.

HURTSBORO, ALA.—The Council, it is reported, has engaged the J. B. McCrary Company, of Atlanta, Ga., as consulting engineer, in connection with the construction of an electric-light plant.

PHOENIX, ARIZ.—The Arizona Construction & Finance Company, recently incorporated, contemplates the construction of an electric railway in this section. The company is capitalized at $2,000,000. The incorporators are : R. A. Lewis, W. B. Barr and S. D. Dunlap.

OSCEOLA, ARK.—The Board of Commissioners is contemplating the installation of a municipal electric-light plant and would like to correspond with parties relative to construction of and equipment for same. W. J. Lamb is a member of the commission.

BEAUMONT, CAL.—It is reported that C. H. L. Ghreist, owner of the Newport Beach electric-light and power plant, is contemplating the installation of an electric-light plant in Beaumont. He also purposes to install an ice plant and steam laundry in connection with the electric plant.

DELANO, CAL.—The Delano-Linne Valley Telephone Company, recently incorporated, with a capital stock of $10,000, by Benjamin Thomas, J. C. Rutledge, A. Villard, P. Girard and R. W. Lockridge, purposes to build a telephone system in Delano and Linne Valley.

FRESNO, CAL.—The construction of an electric railway from Fresno to the San Joaquin River, via the Bullard district, is under consideration. F. C. Forkner is reported to be interested in the project.

FRESNO, CAL.—The Fresno, Coalinga & Tidewater Railway Company is reported to be contemplating the construction of an electric railway from Fresno to Monterey, for which surveys are being made.

FRESNO, CAL.—Investigations are being made by the San Joaquin Valley Electric Railway Company with a view of extending its line from Modesto to Fresno. The company is now building a railway from Stockton to Modesto. M. S. Brackett is general manager.

LOS ANGELES, CAL.—The Llewellyn Iron Works have been awarded a contract for the installation of four direct-connected electric freight elevators in the new building of the Haas Building Company, located on Alameda Street, at $10,950.

MARYSVILLE, CAL.—The contract for erecting seven arches to be used for lighting the business section of Marysville has been awarded to the Butte Construction Company, of San Francisco, Cal., for $6,100.

MODESTO, CAL.—The Western States Gas & Electric Company is planning to extend its transmission line from Stockton to Modesto to supply electricity in Modesto and other Stanislaus County towns.

NEWPORT BEACH, CAL.—The proposition to issue bonds to the amount of $60,000 for the installation of a municipal electric and gas plant will be submitted to a vote of the people at an early date.

OAKLAND, CAL.—The Sierra & San Francisco Power Company has notified the City Council that it proposes to supply electricity for lamps and motors in Oakland, subject to the ordinances of the city.

OAKLAND, CAL.—The Sierra Electric Power Company, recently incorporated, proposes to supply electricity for lamps and motors and also water for domestic purposes. The company is capitalized at $3,000,000 and the incorporators are: Charles Gross, J. E. Powers, E. A. Herman, H. L. Breed and M. S. Hamilton, all of Oakland, Cal.

ROSEVILLE, CAL.—The Board of Trustees, it is said, will offer the Pacific Gas & Electric Company $10,000 for its local plant. The company has heretofore refused to sell the system.

SANTA ROSA, CAL.—The Clear Lake Telephone & Telegraph Company and the Sonoma Valley Company, of Sonoma, Cal., which supplies electricity for lamps and motors in Sonoma Valley, have been consolidated. The headquarters of both companies will be located in Santa Rosa. Fred L. Wright is president of the telephone company and C. T. Ryland, of Sonoma, is head of the Sonoma Valley Company.

TULARE, CAL.—The Tulare County Power Company is planning to push the work on its new power plant in Globe, in order to be able to install the machinery during 1912. The company also contemplates building an underground conduit system in the business district in Tulare.

WILLOWS, CAL.—The Sacramento Valley Power Company has purchased the plant and holdings of the People's Power Company, a local corporation, and will enter into competition with the Northern California Power Company in Glenn County field. The Sacramento Valley Power Company will make extensions to its holdings in this section which will involve an expenditure of $150,000. The rate offered by the Sacramento company is 25 per cent lower than the present price asked by the Northern California Power Company.

WINTERS, CAL.—The Vallejo & Northern Railway Company, it is reported, is contemplating the construction of an electric railway to Winters.

LONGMONT, COL.—The City Council has awarded the contract for the installation of a distributing system in connection with the new electric-light plant to Hendrie & Bolthoff, of Denver, Col., at $18,654. Bonds to the amount of $46,000 were voted at the last city election for the construction of a municipal electric-light plant. After the bonds had been sold, a site secured and other preliminary work done a legal question arose which changed the situation. The site selected is in the foothills above Lyons. It was contended that the city has no right to build a plant outside of the corporate limits and that the city has no right to the water for power purposes. To avoid complications a company was organized as the Public Service Company, capitalized at $50,000, and the stock disposed of among the citizens. The company has taken over the rights and titles held by the city and is to build the plant as proposed by the city and transmit energy to the city limits. The city will own and operate the distributing system. Under the terms of the agreement the city reserves the right to purchase the plant for its face value.

WASHINGTON, D. C.—An engineer connected with a contracting firm in Australasia, and who is directing work on a railway tunnel through certain mountains, informs an American consul that he would like to communicate with American concerns dealing in electrically operated rock-drilling machinery. He wishes descriptions of such machinery and also prices at which it could be furnished at the point of destination. Further information may be secured by addressing No. 7559, Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C.

WASHINGTON, D. C.—A report from an American consulate states that an electric company has recently been formed in his district, with an American electrical engineer as the managing director, which proposes to supply heat, light and power to the entire district. The company will be in the market for machinery and equipment for the entire plant, and also for all kinds of light, heat and power fixtures and appliances. The managing director would like to receive catalogs along the line mentioned with prices f.o.b. San Francisco, Cal. Further information may be obtained by addressing No. 7558, Bureau of Manufactures, Department of Commerce and Labor, Washington, D. C.

FAIRBURN, GA.—The City Council is reported to have awarded a contract to the J. B. McCrary Company, of Atlanta, Ga., for the construction of an electric-light plant, for which bonds to the amount of $10,000 have been issued.

MARSHALLVILLE, GA.—The City Council has awarded a contract to J. C. Walker, of Marshallville, to supply the town with water and electricity for street lighting. A stock company capitalized at $40,000 will be organized to construct the plant and carry out the contract.

PERRY, GA.—The City Council has contracted with J. H. and J. A. Davis, of Lakeside, for energy for the electric-light system for Perry. They agree to deliver electricity at a point east of the town, where it will be connected with the city system. Bonds to the amount of $6,000 have been authorized for installation of the system.

PRESTON, IDAHO.—Preparations are being made by the Idaho & Utah Electric Company for the construction of an electric plant, work on which will begin in the near future. The company proposes to extend its system to Franklin, Weston, Richmond, Whitney, Trenton and Smithfield soon. Energy for operating the system will be purchased from the Telluride Power Company. The cost of the plant is estimated from $12,000 to $15,000. H. E. Smoot is president and general manager.

TWIN FALLS, IDAHO.—The Mountain States Telephone & Telegraph Company will soon begin work on the erection of a telephone line from Twin Falls to Rogerson.

ALBION, ILL.—The Albion Electric Light & Gas Comany has commenced work on the construction of an electric-light plant in Albion. The company will apply to the Council for an extension of the contract with the city, in which it agreed to have the plant completed by Dec. 15, 1911.

BARRY, ILL.—The Electric Light & Power Company is planning to rebuild its transmission line from Barry to Kinderhook and to erect an extension from there to Hull. The company has entered into a contract with the village authorities in Hull to supply electricity in that place.

CARTHAGE, ILL.—The Carthage Electric Light & Heating Company has changed its name to Albert Sandt & Company. The capital stock of the company has been decreased from $50,000 to $10,000 and the headquarters changed from Carthage to Chicago.

CHICAGO, ILL.—W. O. Johnson, operating receiver for the Chicago & Milwaukee Electric Company, has been authorized by the United States District Court to purchase property for right-of-way in Willmette and Highland Park.

CHICAGO, ILL.—Plans are being considered by the Public Service Corporation of Northern Illinois, which is a consolidation of the North Shore Electric Company, Economy Light & Power Company, Illinois Valley Gas & Electric Company and others, for a bond issue covering the properties to retire existing bonds by purchase or ultimate exchange

and also for extensions and improvements to the properties. It is expected that the initial offering will be about $4,250,000.

CHICAGO, ILL.—Bids will be received by the directors of the Municipal Tuberculosis Sanitarium, city of Chicago, Ill., Room 1514, Fort Dearborn Building, 105 West Monroe Street, Chicago, Ill., until Nov. 13 for the construction complete, including plumbing, sewage-disposal system, water-supply system, boilers, pumps, heating, steel tank, tile roofing, electric work, etc., of a power house and water tower for the Municipal Tuberculosis Sanitarium of the city of Chicago, located at North Fortieth and Bryn Mawr Avenues, Chicago. The cost of the proposed hospital is estimated at $800,000. W. A. Otis and Edwin H. Clark, 150 South Dearborn Street, Chicago, Ill., are architects.

KANSAS, ILL.—The property of the Embarras Telephone Company in Kansas is reported to have been purchased by Roy Hall, of Westfield, Ill. It is understood that the new owner will make improvements to the system.

MONMOUTH, ILL.—The Western Stone Company has contracted with the Monmouth Public Service Company to supply electricity to operate its No. 2 plant.

NEWMAN, ILL.—The Newman Electric Light Company has decided to erect a new electric plant just east of the city. The company, it is said, will install an ice plant in connection with the electric plant. The power plant of the company was recently destroyed by fire, since which the town has been without electrical service.

ODELL, ILL.—Preparations are being made to install an ornamental street-lighting system in Odell. The present arc lamps will be replaced with four-cluster tungsten lamps.

ROCK ISLAND, ILL.—The City Commission has granted the People's Power Company permission to erect a transmission line to its dam at Sears.

ROCK ISLAND, ILL.—At an election held recently the voters defeated the proposition to grant a fifty-year franchise to the Tri-City Automatic Home Telephone Company. The voters also refused to approve the ordinance consenting to the sale of the Union Electric Telephone plant to the Central Union Telephone Company.

URBANA, ILL.—The capital stock of the Kankakee & Urbana Traction Company has been increased from $200,000 to $500,000.

WASHBURN, ILL.—The property of the Washburn Electric Company has been purchased by T. R. Voorhees, of Fairbury. The new owner, it is said, will make improvements to the plant and erect transmission lines to small towns in the vicinity of Washburn.

BEDFORD, IND.—The City Council has decided to adopt the tungsten street-lighting system under the new contract submitted by the Bedford Heat, Light & Power Company,. The arc lamps cost $80 each per year, while the tungsten lamps of 250 cp will cost but $50 each per year. The 40-watt lamps to be used at the street intersections will be supplied at $15 per lamp per year. The cluster lamp system, promoted by the Merchants' and Industrial Association, the standards to be equipped with one 60-watt and four 40-watt lamps, have been approved for the street corners, while the posts between will be equipped with one 60-watt and two 40-watt lamps. The three-lamp posts, the top lamp burning all night, will cost $25 each per year, while the five-lamp standards will cost $34 each per year. Notwithstanding that twenty arc lamps will be added to the number already in use and including the cluster-lamp system, it is estimated that the city will save about $265 per year under the new system.

CAMBRIDGE CITY, IND.—The Town Council is reported to have awarded the contract for the construction of the new municipal electric-light plant to Roy Kniese, of Cambridge, for $4,087.

GARY, IND.—The Gary & Southern Traction Company has filed an amendment to its charter increasing its capital stock from $10,000 to $300,000.

BURLINGTON, IA.—It is reported that the Chicago, Burlington & Quincy Railroad Company is contemplating the construction of an electric power plant in Burlington, for which an appropriation of $40,000 is said to have been made. The plant, it is understood, will be located near the Union Depot and will supply electricity for lighting the yards, depot, freight house and other buildings.

DUBUQUE, IA.—Extensive improvements and extensions are being made by the Union Electric Company, which will more than double the output of its plant. The company is now installing a 2500-kw, six-stage horizontal Curtis turbine.

FAIRFIELD, IA.—The City Council is reported to have entered into a contract with the Iowa Power Company, of Oakland Mills, whereby the company will supply electricity to the city at 3 cents per kw-hour. The present arc-lamp system will be replaced with cluster lamps.

GLIDDEN, IA.—It is reported that the proposition to issue bonds to the amount of $10,000 for the installation of an electric-light plant will be submitted to a vote at an election to be held this month.

MANCHESTER, IA.—The local electric-light plant, owned by E. W. Hoag, was destroyed by fire on Oct. 28, causing a loss of about $10,000. Arrangements have been made with the Manchester Light, Heat & Power Company to supply the patrons of the Hoag plant, which, it is said, will be rebuilt at once.

MUSCATINE, IA.—The Board of Supervisors has decided to install an electric-lighting system at the Muscatine County Farm. Improvements will also be made to the heating system.

NEW SHARON, IA.—At a special election held recently the proposition to grant the Oskaloosa Traction & Light Company a franchise to supply electricity for lamps and motors in New Sharon was carried.

PILOT MOUND, IA.—At an election held recently the proposition to grant a franchise to install an electric-light and power plant was carried.

PRAIRIE CITY, IA.—The Colfax Electric Light & Power Company, of Colfax, Ia., has been granted a franchise to operate an electric-light and power plant in Prairie City for a period of twenty-five years. The company will erect a transmission line from Colfax to this city, to be completed by Jan. 1, 1912. A substation will be erected here.

VAN HORNE, IA.—Sealed bids will be received by P. R. Holler, town clerk, Van Horne, Ia., until Nov. 13 for furnishing and installing machinery, equipment and material for a complete electric plant, consisting of a 30-kw direct-current generator direct-connected to an oil engine, storage battery and switchboard. Separate bids will be entertained for furnishing and installing the storage battery complete. Alternate bids will be received on one 20-kw direct-current generator belted to an oil engine and one 10-kw direct-current generator belted to an oil engine, together with switchboard, all installed complete for operation. Plans and specifications may be seen at the office of the town clerk, or at the office of J. B. Hill, engineer, Iowa City, Ia. Copies of plans may be obtained on application to the engineer on payment of $3 to cover cost of the prints. William Baumgardner is Mayor.

EARL, KAN.—The City Council has granted to James Z. George, of Memphis, franchises to construct and operate an electric-light plant and to operate the water-works system in Earl. The city formerly owned the water-works, but sold the entire system to Mr. George, who proposes to enlarge and improve the same.

KANSAS CITY, KAN.—Business men on Minnesota Avenue between Fifth and Sixth Streets and Seventh and Eighth Streets are planning to erect ornamental lamp standards in the business district. It is proposed to erect ornamental lamp standards, each carrying five lamps, along Minnesota Avenue.

LAWRENCE, KAN.—Sealed bids will be received at the office of the county clerk of Douglas County, Lawrence, Kan., until Nov. 13 for furnishing one gasoline-engine-driven electric generating set, gasoline system, storage set, storage battery, electric pumps, pressure tanks and necessary piping for water system for the County Home of Douglas County.

MANHATTAN, KAN.—Plans are being considered by J. J. Marshall, manager of the Marshall Theatre, for the installation of an isolated electric plant to supply electricity to light the entire building.

ROSSVILLE, KAN.—The question of erecting an electric-light and power plant at the mill dam north of Rossville is reported to be under consideration.

COVINGTON, KY.—Preparations are being made by the Chesapeake & Ohio Railroad Company for the construction of a new power station at its yards in Covington, to cost about $15,000, work on which will begin at once. The new plant will supply electricity to operate all the Chesapeake & Ohio Railway telegraph lines in this section of the company.

DONALDSVILLE, LA.—The City Council is reported to be contemplating the installation of a municipal electric-light plant and water-works system in Donaldsonville.

LIVERMORE FALLS, MAINE.—The electric power station of the International Paper Company at Jay Bridge was destroyed by fire on Oct. 28, causing a loss of about $14,000. The plant had an output of 3000 hp and supplied electricity to operate the Otis Mills of the International Paper Company at Chisholm and for operating the lighting system of the entire plant of the company at that place. It is understood that the company is planning to erect a new station for which plans have already been drawn.

BALTIMORE, MD.—In the report submitted to the Board of Estimate by Superintendent McCuen the cost of lighting the streets for the coming year is estimated at $375,517, which includes 350 additional lamps. In addition $14,230 will be required for a system of ornamental lamps on Charles Street, between Twenty-ninth Street and University Parkway, between St. Paul Street and the city limits, also between Thirty-first Street and University Parkway after it has been built up.

HAVRE DE GRACE, MD.—The plant and holdings of the Havre de Grace Electric Light Company have been purchased by James H. Harlow, of Darlington, Md. Mr. Harlow owns the plant at Perryville and is interested in a plant at Belair, and it is understood that he proposes to merge the plants and supply power from one plant.

MIDDLETOWN, MD.—The citizens have authorized the burgess and commissioners to enter into a ten-year contract with the Frederick Gas & Electric Company, of Frederick, for lighting the streets of the town. It is proposed to use tungsten lamps erected on ornamental standards. It is thought that from fifty to sixty street lamps will be required. The company will erect a transmission line over the mountain from its power house to Middletown.

CHELMSFORD, MASS.—Preparations are being made by the Lowell Electric Light Corporation for installing a street-lighting system in Chelmsford. Under the terms of the contract the company is to erect not less than 342 tungsten lamps of 40 cp, to be located along the streets of Chelmsford Centre and of North, South, East and West Chelmsford, at a cost of $55.75 per month.

FRANKLIN, MASS.—The Union Electric Light Company is installing

a large generator in its plant in Franklin, which will be used for auxiliary and emergency purposes.

HOLDEN, MASS.—The contract for erection of pole line, apparatus for a substation and other material for the construction of a distributing system to supply electricity in Holden has been awarded to the Western Electric Company, to cost approximately $9,700.

HOLYOKE, MASS.—It is reported that the American Thread Company is contemplating equipping its Holyoke plants for electric-motor drive.

PITTSFIELD, MASS.—E. D. Jones & Company have decided to utilize electricity to operate their foundry and machine shop, which will be supplied by the Pittsfield Electric Company. The steam plant will be dismantled at once.

SWANSEA, MASS.—The Fall River Electric Light Company is planning to extend its system to Swansea to supply electrical service in this town.

WORCESTER, MASS.—Arrangements have been made whereby all gasoline lamps now in use in Worcester will be replaced by electric incandescent lamps by June 1, 1912. The contract for the gas lamps expires this month, but the Welsbach company has agreed to allow the city to use its lamps until the Worcester Electric Company is ready to supply the service.

BARAGA, MICH.—The Village Council has awarded contracts for installing an eltctric-light plant and improvements to the water-works system to the combination bids of the Central Combination Company, of Oshkosh, Wis.; the National Meter Company, of Chicago, Ill., and the Electric Equipment Company, of St. Paul, Minn., at a total amount of $28,676. The Village Council has decided to install sixty ornamental lamp standards with tungsten clusters to replace the present street-lighting system.

CASSOPOLIS, MICH.—The Board of County Supervisors has appointed a committee to make investigations in regard to installing an electric-lighting system in the county court house to replace the oil lamps now in use.

KALAMAZOO, MICH.—Plans and specifications are being prepared for wiring, heating and ventilating the new addition to the Central High School building in this city, bids for which will be asked about Dec. 5. Ammerman, McCall & Anderson, of Detroit, Mich, are engineers.

CHISHOLM, MINN.—It is reported that plans are being considered by A. McMillan, of Chicago, Ill., for the development of water-power on the Sturgeon River, 20 miles north of Chisholm, to furnish electricity to the mines in this vicinity.

FERGUS FALLS, MINN.—The Otter Tail Power Company, it is reported, contemplates extensive improvements and extensions to its plant, involving an expenditure of about $250,000.

NASHWAUK, MINN.—Preparations are being made for the installation of an electric-light plant at the Hawkins Mine to supply electricity for lighting the mine, machine shops, office and residences at the Hawkins location. A large generator will be installed at the power house of the washing plant. A telephone line is now being erected between the Hawkins Mine and the washing plant, under the direction of H. E. Sypole, of Chicago, Ill., who will have charge of installing the switches and extending the wires for the electric-light system.

THIEF RIVER FALLS, MINN.—The City Council has awarded a contract to the Northwestern Electric Equipment Company, of St. Paul, Minn., for two 225-hp Diesel oil engines and two 150-kw direct-current generators for the new municipal electric-light plant. The cost of the plant complete is estimated at about $50,000.

LAUREL, MISS.—The Laurel Electric Power & Light Company, recently incorporated with a capital stock of $75,000, is contemplating the construction of an electric-power plant and street railway in Laurel. P. H. Saunders, Herbert Jones and S. M. Jones are the incorporators.

KANSAS CITY, MO.—The Municipal Art League, of Kansas City, has offered prizes for the best designs for lamp standards for the illumination of tne business district. Designs are asked for an ornamental standard, 14 ft. high, to provide for not less than five lamps; also for an ornamental lighting bracket to be attached to the present steel trolley poles, to be not more than 6 ft. long and to provide for not more than four lamps, designed to include an ornamental base for trolley poles at pavement level. Designers are referred to the lamp standards now in use in Paris, Brussels, Berlin, Des Moines, Los Angeles, Atlanta, Denver and Minneapolis. The Kansas City Advertising Committee has obtained permission from the property owners to install lamps for experimental purposes on one block on Walnut Street. Designs are to be submitted to the Lighting Contest, Municipal Art League, 306 Studio Building, Kansas City, Mo., on or before Dec. 9.

KING CITY, MO.—Application has been made to the City Council by local capitalists for a franchise to install and operate an electric-light plant in King City.

MARYVILLE, MO.—The Maryville Electric Light & Power Company, it is reported, is contemplating extensive improvements, which will double the output of the plant and involve an expenditure of about $9,000.

ST. LOUIS, MO.—The Light & Development Company, of St. Louis, has increased its capital stock from $100,000 to $200,000.

COLUMBUS, MONT.—J. P. Pouscaren, civil engineer, it is reported, has been granted permission by the Secretary of Agriculture to construct dams on the upper Stillwater River and Woodbine Creek, the power to be utilized to generate electricity. It is estimated that 11,000 hp can be developed.

GLENDIVE, MONT.—The Glendive Heat, Light & Power Company, recently organized, has taken over the property of the Hughes Electric Company, including the local telephone exchange, electric-light plant and municipal heating plant. The company contemplates a number of improvements, including a new telephone system, for which orders for equipment have already been placed.

GREAT FALLS, MONT.—The City Council has accepted the bid of the Northern Idaho & Montana Power Company for street lighting. Under the terms of the franchise the company agrees to supply electricity for new electroliers at $48 per month. Suspended lamps will cost $4.50 per cluster and 60-watt tungsten lamps in the outskirts of the city $1.50 each per month.

LIBBY, MONT.—Preparations are being made for the construction of a large hydroelectric power plant at the Yakt Falls, 18 miles northwest of Libby, by the Milwaukee Power Company. It is proposed to develop 3400 hp in two units of 1700 hp each. A portion of the energy generated at the proposed plant will be used by the Lincoln Gold Mining Company, which owns the Sylvanite mines. J. H. Ehlers, of Spokane, Wash., is interested in the company.

POLSON, MONT.—The Flathead Power & Traction Company, recently incorporated, proposes to build an electric railway between Polson and Dixon, a distance of about 30 miles. F. L. Gray, G. R. M. Stritzel, T. R. Arnold, F. E. Faucett and A. W. Pipes, all of Poulson, Mont., are among the incorporators.

OMAHA, NEB.—Preparations are being made by the Nebraska Transportation Company for the construction of a steam power plant on the Elkhorn River, near Elk City, Neb. About 21,000 hp will be developed.

OMAHA, NEB.—The Bullock Public Service Company has changed its name to the Iowa-Nebraska Public Service Company. The headquarters of the company have been changed from Omaha, Neb., to Norfolk, Neb.

OVERTON, NEB.—Contracts have been awarded by W. H. Hill for the installation of an electric-light plant in Overton.

RENO, NEV.—Surveys have been completed by the Nevada Power & Transportation Company for power sites and ditches from the Truckee River east of Reno in connection with its proposed power development. The company has located two power sites on which it proposes to erect two power plants capable of developing 9000 hp. Work will soon begin on construction of the system.

CANAAN, N. H.—Preparations are being made for installing an electric-light plant at the Goss mill. It is understood that the plant will supply electricity for lighting the town.

MANCHESTER, N. H.—The New Hampshire Water & Electric Power Company has applied to the Public Service Commission for permission to extend its transmission lines and engage in business in Fitzwilliam, Rindge, Richmond, Winchester and Peterborough.

TRENTON, N. J.—The Trenton-Mercer County Traction Company is planning to install a 1100-hp De Laval steam turbine at its power plant in Trenton.

AMSTERDAM, N. Y.—The plant and holdings of the Empire State Power Company were sold at a foreclosure sale on Oct. 28 by a representative of the New York Trust Company, which is trustee for the bondholders, to the Stone & Webster syndicate, of Boston, Mass., which also has taken over other properties controlled and operated by the Hudson River Electric Power Company. The price paid for the property was $615,000.

BINGHAMTON, N. Y.—At an election held recently the proposition to establish a municipal electric-light plant in Binghamton was carried.

CORTLAND, N. Y.—The contract for electric wiring and fixtures for the State Normal School, in Cortland, has been awarded to the conduit Electric Company, of Syracuse, N. Y., for $6,984.

KEESEVILLE, N. Y.—The Keeseville Electric Company has applied to the Public Service Commission, Second District, for permission to execute a mortgage for $200,000 on all its franchises and property to secure an issue of bonds of like amount.

ONEIDA, N. Y.—The Stone & Webster Management Association, which has taken over the property of the Madison County Gas & Electric Company, of Oneida, has submitted a proposition to the Board of Public Works offering arc lamps for street lighting at the rate of $75 each per year with all-night service and $50 per lamp per year to burn until 1 o'clock. The board is considering the installation of tungsten lamps.

SARATOGA SPRINGS, N. Y.—Bids will be received until Nov. 30 for lighting the streets of the city with gas or electricity for a period of four years. The present street-lighting system consists of 154 arc lamps, 180 incandescent lamps and 226 gas lamps.

ENFIELD, N. C.—The town of Enfield has authorized bonds to the amount of $10,000, the proceeds to be used for the installation of an electric-light system. Bids will be received for the bonds until Dec. 6, 1911. W. T. Clement is Mayor.

SANFORD, N. C.—The Carolina Light & Power Company, it is reported, is contemplating the installation of additional machinery at its plant, including a 500-kw transformer and lightning arresters. The volt-

age will be increased from 35,500 to 66,000. Charles E. Johnson, of Raleigh, N. C., is president.

BEXLEY (STATION R, COLUMBUS), OHIO.—Bids will be received by George E. Fry, village clerk, until Nov. 14 for furnishing material and installing an electric-lighting system in Bexley.

CLEVELAND, OHIO.—Plans are being considered by Director Lea and the City Council whereby the city of Cleveland will supply electricity for lamps, heat and motors to the merchants in the vicinity of East 105th Street and Euclid Avenue. The pending franchise, granting Harvey Brothers the right to sell excess power to merchants in that vicinity, is under consideration and Director Lea proposes that the city purchase the energy and sell it at the same rate as is charged by the city for electricity supplied by the Collinwood and the South Brooklyn electric stations. The city will pay for the conduits and wiring with money earned by the municipal plants.

COLUMBUS, OHIO.—Sealed proposals will be received by S. H. Holton, director of public service, Columbus, Ohio, until Nov. 20 for furnishing material and labor for additions and alterations to the municipal electric-light plant, located on West Spring Street, in accordance with plans and specifications on file in the office of the director, in custody of Wirt S. Scott, superintendent of the municipal electric-light plant. Copies of plans and specifications may be obtained on application to the above office.

GUTHRIE, OKLA.—The City Council is considering the question of taking over the water-pumping plant of the Guthrie Light & Power Company. Under the terms of the contract the city has the option of terminating the contract on Dec. 1, 1911. To take over complete control of the plant this winter will require the purchase of part of the power equipment now in use at the station. Three years from now the contract may be terminated without the purchase of any of the equipment. The cost of taking over the plant is estimated at from $8,000 to $15,000.

KINGFISHER, OKLA.—Plans and specifications are being prepared by the Benham Engineering Company, American National Bank Building, Oklahoma City, Okla., for extensions to the municipal electric-light plant and water-works system, for which bonds to the amount of $30,000 have been voted.

PONCA CITY, OKLA.—At an election held Oct. 31 the proposition to issue bonds to the amount of $30,000, the proceeds to be used for the construction of a municipal electric-light plant, was carried.

TALIHINA, OKLA.—It is reported that a movement has been started in Talihina to install a municipal electric-light plant. The City Council has voted to issue bonds for a water-works system.

FLORENCE, ORE.—At an election held recently the citizens voted against the proposition to grant franchises to the Florence Electric Company to install an electric-light and power plant and the Florence-Mapleton Independent Telephone Company to operate a telephone system. The franchises were denied owing to the form in which they were drawn.

HOOD RIVER, ORE.—The Hydro-Electric Company has begun active construction on its power plant at the Tucker Bridge, about 5 miles from the city. The initial installation of 750 hp will be utilized in Hood River. Additional equipment will be installed to supply electricity at The Dalles, where the company has a franchise.

VALE, ORE.—The City Council requests proposals from any parties who will supply electricity for lamps and motors in Vale at lower rates than now charged. The Oregon-Idaho Light & Power Company has been asked to install a system. The Vale Light & Water Company now supplies electrical service in this city.

EBENSBURG, PA.—The Ebensburg Light, Heat & Power Company is contemplating extending its transmission lines to Loretto to supply electricity for lamps and motors. It is also proposed to supply electrical service to residences along its line between Ebensburg and Loretto.

JOHNSTOWN, PA.—The Johnstown & Altoona Railway Company is contemplating the purchase of two 750-kw turbo-generators, water-tube boilers with a rating of 1200 hp, with necessary condensers, piping and pumps. G. U. G. Holman, 52 Williams Street, New York, N. Y., is agent.

LEWISBURG, PA.—The capital stock of the Citizens' Electric Company has been increased from $15,000 to $40,000.

NEW CASTLE, PA.—Application will soon be made by the Connoquenessing Power Company for a charter for the purpose of building an electric-power plant on Slipperyrock Creek, 11 miles east of New Castle. The incorporators are: F. G. Ross, Arthur Barnes and J. H. Roelofs, all of Pittsburgh, Pa.

NEW CASTLE, PA.—D. M. Hosford, consulting engineer, of Cleveland, Ohio, engaged by the City Council to furnish an estimate of the cost of installing a municipal electric plant, has submitted two plans, one for a steam-driven plant, the cost of which is estimated at $193,000, and the other for a gas-engine-driven plant, which would cost approximately $185,237.

WAYNESBURG, PA.—Plans and specifications are being prepared by the Waynesburg & Blacksville Street Railway Company for the construction of a power plant in Waynesburg, bids for which will soon be asked for.

EDGEFIELD, S. C.—The J. B. McCrary Company, of Atlanta, Ga., has been awarded the contract to construct an electric-light plant in Edgefield, to cost $14,000.

SUMMERVILLE, S. C.—The Village Council has authorized the Mayor to enter into a contract with the Augusta-Aiken Railway & Light Company for street lighting. The contract calls for 200 tungsten lamps of 60 cp and eight or ten arc lamps. The town will be rewired throughout. Through oversight this item appeared under Summerville, Ga., in the issue of Nov. 4.

GARRETSON, S. D.—It is reported that J. A. Wiberg, of Luverne, Minn., has decided to install an electric-light plant in Garretson.

WHITE, S. D.—Application has been made to the Town Council by E. A. Harscim for a franchise to establish an electric-light plant in White.

WINNER, S. D.—Application has been made to the Council by B. H. Martin, of Dallas, for a franchise to install an electric-light plant in Winner.

CHATTANOOGA, TENN.—Application has been made by the Chattanooga Traction Company for a charter to construct and operate an electric railway in Chattanooga under a franchise granted by the City Council several months ago. The company also proposes to build interurban lines, of which the first will be to Dayton, Tenn., through Hamilton and Rhea Counties. Another line will be built to the Georgia State boundary, the terminus of which will be at Ringgold, Ga. It is also proposed to build a railway up Lookout Mountain. Electricity for operating the proposed railways will be secured from a hydroelectric plant now being constructed near Chattanooga. The company is capitalized at $100,000. C. E. James, D. F. Beckhaw, J. L. Davies and Franklyn Harris are interested in the project.

KNOXVILLE, TENN.—Application has been filed with the County Court for a charter for the Knoxville Light & Power Company. The company will be capitalized at $500,000 and proposes to control the energy generated by the Eastern Tennessee Power Company, to be distributed in this vicinity.

TRENTON, TENN.—The City Council has purchased a site on North Eaton Street, just east of the W. & O. railroad tracks, on which it will erect an electric-light plant. The Council will issue warrants to the city treasurer to defray the cost of the plant. The citizens recently voted to issue $12,000 in bonds for an electric-light system. Messrs. Keenan & Wade enjoined the Council from issuing and selling the bonds. It is expected to have the system ready for operation by the first of the year.

DALLAS, TEX.—The installation of an ornamental street-lighting system on Main Street is under consideration.

DALLAS, TEX.—Application has been made to the County Commissioners by John T. Witt for a thirty-year franchise to construct and operate an electric interurban railway over the West Dallas-Commerce Street turnpike.

GALVESTON, TEX.—It is reported that the plant and holdings of the Brush Electric & Power Company, of Galveston, Tex., have been purchased by the Newman interests, of New Orleans, La. The consideration is said to be between $750,000 and $800,000.

GUFFEY, TEX.—The Beaumont Ice, Light & Refrigerating Company, of Beaumont, Tex., has extended its transmission lines to Spindle Top for the purpose of supplying electricity to operate the oil wells there.

HOUSTON, TEX.—Plans are being considered for extensive improvements and extensions by the Houston Electric Company to its street-car system during the coming year, which will involve an expenditure of about $750,000.

M'KINNEY, TEX.—The Union Telephone Company has purchased a building on North Kentucky Street and will establish a long-distance and local telephone system in McKinney. The company will place its wires underground in the business section. This city will be the headquarters of the company for this district.

TAYLOR, TEX.—The United Telephone Company is contemplating the installation of a new switchboard and other equipment in its local exchange. E. A. Glass, of Austin, Tex., is general manager.

WACO, TEX.—The citizens of Waco have subscribed to $150,000 in capital stock of the Dallas-Waco Interurban Railway, and negotiations have been closed for building the railway to Waco. In addition to extending the interurban line to Waco, the company has announced that it will build a power plant near this city, to cost about $500,000.

ORLEANS, VT.—The town of Orleans has contracted with the North Troy Electric Light & Power Company, of North Troy, Vt., to supply electricity to operate the local electric-light system. The company will erect a transmission line to Orleans. The contract is for a term of fifteen years with the privilege of renewal for five or ten years. The present contract with the town of Barton, which supplies electricity for the local system, expires in December, 1912.

SPRINGFIELD, VT.—The Springfield Electric Company has commenced work on the construction of a new power house on the site of the old building.

WAITSFIELD, VT.—The town of Waitsfield has awarded a contract to Moody & Almon, of Montpelier, Vt., to supply electricity for lamps and motors in this village and also to the farms along the route of its transmission line. The town has also voted to exempt the property of the company for a period of ten years. The transmission line will be extended from Moretown.

CHEHALIS, WASH.—Application has been made to the City Council

for a franchise to install a local exchange and telephone system in Chehalis.

SEATTLE, WASH.—The Highland Park & Lake Burien Railway Company, which recently awarded a contract for the construction of an electric railway from Oxbow to Lake Burien, has filed articles of incorporation with a capital stock of $125,000. W. H. Murphy, L. I. Gregory and D. I. Burkhart are among the incorporators.

WENATCHEE, WASH.—The Wenatchee Valley Power & Electric Company has awarded a contract to J. T. Munyon for grading its proposed line in this vicinity.

WHITE SALMON, WASH.—A bid has been submitted to the Mount Adams Electric Railway Company by Bertleson & Sons, of Tacoma, Wash., offering to construct its proposed railway from a point near the Columbia River to White Salmon for $42,000.

NEW MARTINSVILLE, W. VA.—The plant and holdings of the New Martinsville Electric Light, Heat & Power Company have been purchased by the Sisterville Electric Light & Power Company for $20,150. The property was sold at public sale. The Sisterville company will supply electricity generated at its plant in Sisterville in New Martinsville as soon as improvements and extensions are completed.

PEWAUKEE, WIS.—The local electric-light plant and lighting contracts, with water privilege at Pewaukee, have been taken over by the Milwaukee Electric Light & Railway Company, of Milwaukee. Additional power needed in Pewaukee will be furnished from the plant of the Milwaukee company at the Kilbourne dam on the Wisconsin River. The company has also been granted a franchise to erect transmission lines and electric railway on the streets and highways in Pewaukee.

WAUSAU, WIS.—Plans are being considered by the Wausau Street Railway Company, the Marathon Paper Mills Company and the Wausau Sulphate Company, of Mosinee, for the construction of a joint power plant near Wausau.

WEYAUWEGA, WIS.—The property of the Weyauwega Electric Light Company, including water privilege, electric-light plant, flour mill, elevator and factory building, was sold at auction on Oct. 23 to Charles Peterson, of Weyauwega, for a consideration of $15,000. The property was appraised at the assignment at $60,000.

WILMOT, WIS.—The installation of an electric-light plant is reported to be under construction. Power for operating the plant will be secured from the dam of the local mill.

EDMONTON, ALTA, CAN.—The Council, it is reported, has decided to purchase a surface condenser for the municipal electric-light plant as recommended by A. J. Latornell, chief engineer, bids for which will be called for. The cost of the condenser is estimated at about $5,000.

NANAIMO, B. C., CAN.—The British Columbia Company, of Victoria, B. C., it is stated, has submitted a proposition offering to install a street-railway system provided the Council will guarantee the interest on bonds to the amount of $150,000. It is understood that a by-law is being prepared. A. G. Waters is city engineer.

ST. JOHN, N. B., CAN.—An agreement has been reached between the New Brunswick Hydro-Electric Company and the sub-committee of the Council whereby the former will be allowed to enter the city and erect a distributing system to supply electricity for lamps and motors. It is understood that the terms of the agreement provide for a substantial reduction in rates to all consumers for both lamps and motors. If the Council approves of the agreement, the company will begin work at once on its proposed system.

BADEN, ONT., CAN.—The by-law authorizing an appropriation of $5,000 for the installation of a distributing system for utilizing electricity in Baden, supplied by the Hydroelectric Power Commission, was carried.

BRACEBRIDGE, ONT., CAN.—Tenders will be received by the town of Bracebridge, Ont., until Nov. 14 for the sale of $8,300 power extension debentures. A. C. Salmon is town clerk.

CAMDEN EAST, ONT., CAN.—The Ontario Power Company, it is reported, is contemplating a power development on the Napanee River, at Camden East, which will involve an expenditure of about $200,000 and include the erection of three generating stations. The proposed work will necessitate rock cutting in river channel, several drains, etc.

KINGSTON, ONT., CAN.—New estimates, it is reported, have been submitted by the Hydroelectric Power Commission for furnishing to Kingston, Brockville, Morrisburg, Cardinal and Prescott fom 3000 to 10,000 hp. Under the new estimates the city of Kingston will pay $30.25 per hp for 3000 hp and $17.80 per hp for 10,000 hp. The price to Morrisburg is quoted at $13.07 per hp for 3000 hp and $11.46 per hp for 10,000 hp. The report does not state where the power will be supplied from, but presumably from Waddington, N. Y., in view of the low rates quoted for Morrisburg. It is a question whether Kingston will accept the offer, as the proposition submitted by the Seymour Power Company is a better one. In case Kingston drops out the price to the other municipalities would be greatly increased.

MIDLAND, ONT., CAN.—The Canada Iron Corporation, Ltd., of Midland, Ont., it is reported, would like to communicate with electrical construction firms in connection with the erection of a short electric transmission line. For further information address A. C. Adams, Midland, Ont.

NORTH BAY, ONT., CAN.—The Town Council is considering the question of establishing a municipal electric-light plant and is negotiating with the North Bay Light, Heat & Power Company with that object in view. The franchise of the company has expired. The local company has been taken over by the Nipissing Power Company, which is controlled by Smith, Kerry & Chace, of Toronto. The Nipissing company has applied for a twenty-one-year franchise and offiers very low rates if the franchise is granted. The Council is also considering the question of securing electricity from the Hydroelectric Commission, and a definite proposition will soon be submitted by the commission to the Council. It is said that the acceptance of the commission's proposition means the expropriation of the Nipissing Power Company's plant at South River, which will be the first action of this kind by the Hydroelectric Commission.

TORONTO, ONT., CAN.—The Barcelona Company, recently organized under the laws of Canada with a capital stock of $25,000,000, proposes to develop water-power of 250,000 hp and to build hydroelectric power plants to supply electricity for lamps and motors in the city of Barcelona and the northeast section of Spain. The company has also secured one of the tramways in Barcelona and valuable concessions for suburban railways. An expenditure of $25,000,000 is contemplated by the company. Dr. F. S. Pearson, Percival Farquhar and other Canadian and English capitalists are interested in the project. The head office will be located in Toronto, Ont.

WATERFORD, ONT., CAN.—A by-law will soon be submitted to the ratepayers to appropriate $7,000 for the installation of an electric-light plant in Waterford.

SASKATOON, SASK., CAN.—The government is planning to install an automatic telephone exchange, to cost about $250,000, work on which will begin at once.

New Industrial Companies.

THE AMERICAN SAFETY DEVICE COMPANY, of New York, N. Y., has been incorporated by Joseph L. Clueas, 30 Church Street; Calvin S. Hunter, 540 West 165th Street, New York, N. Y., and E. A. Denevellis, 91 Maple Avenue, Flushing, N. Y. The company is capitalized at $200,000 and proposes to manufacture appliances used in building and construction.

THE CHICAGO RAILWAY & MILL SUPPLY COMPANY, of Chicago, Ill., has been granted a charter with a capital stock of $5,000 to manufacture and deal in railway machinery and equipment. The incorporators are: A. W. Gillespie, C. B. Royal and J. S. Seeley.

THE DETECTOGRAPH COMPANY, borough of the Bronx, New York, N. Y., has filed articles of incorporation with a capital stock of $50,000 for the purpose of manufacturing machinery and apparatus to protect documents, etc. The incorporators are: J. W. Cameron, G. S. Miller and C. A. Lee, all of New York, N. Y.

THE GORDON ELECTRIC & MANUFACTURING COMPANY, of Chicago, Ill., has been incoporated with a capital stock of $15,000 by Hazel Jones, Otto W. Wermich and Max W. Zabel. The company proposes to manufacture and deal in electrical devices and supplies.

THE MECHANICAL ADVERTISING COMPANY, of New York, N. Y., has been incorporated with a capital stock of $30,000 to manufacture advertising machines and devices. The incorporators are: E. Callahan, of Hartford, Conn.; R. Butler and A. L. Friedberg, of New York, N. Y.

SUPPLIES, INCORPORATED, of New York, N. Y., has filed articles of incorporation, with a capital stock of $50,000, to manufacture and deal in electric lamps and electrical supplies; also to deal in office, hotel supplies, etc. The incorporators are: Harvey Descher, 334 West Fifty-eight Street; Harold R. Zeamans, 98 Morningside Avenue, and Victor R. Grieff, 160 West Seventy-ninth Street, New York, N. Y.

THE WAITE-HAYDEN COMPANY, of Syracuse, N. Y., has been granted a charter with a capital stock of $10,000 for the purpose of manufacturing watchmen's clocks, electric signals, alarms, etc. The incorporators are: Annie S. Waite, Wilbur M. Waite, 113 Lynhurst Avenue; Perry B. Hayden, 230 West Lafayette Avenue, Syracuse, N. Y.

New Incorporations.

MIAMI, ARIZ.—The Miami Electric & Power Company has filed articles of incorporation with a capital stock of $500,000. The incorporators are: C. W. Van Dkye and R. S. Van Dyke.

CHICAGO, ILL.—The Central Station Engineering Company has been incorporated by C. A. Gillham, B. T. Gifford and A. E. Durham. The company is capitalized at $50,000 and proposes to construct and operate public-utility plants.

CHICAGO, ILL.—The West Hammond Gas & Electric Company has filed articles of incorporation with a capital stock of $5,000 for the purpose of furnishing light, heat and power. The incorporators are: Harry W. Darling, George F. Borman and Jefferson L. Fulton.

EAST ST. LOUIS, ILL.—Articles of incorporation have been filed for the Alton & Southern Railway Company with a capital stock of $10,000 to construct an electric railway from a point on the Mississippi

River in St. Clair County, opposite the city of St. Louis, Mo., extending into a point near the northwestern limits of the city of East St. Louis, Ill. The incorporators are: Arthur V. Davis and R. Mellon, of Pittsburgh, Pa.; Charles M. Hall, of Niagara Falls, N. Y.; C. B. Fox, of East St. Louis, Ill., and others.

HAMILTON, ILL.—Articles of incorporation have been filed for the Hamilton Railway Company by George Higginson, of Winnetka, Ill.; Joel D. Harvey, of Geneva, Ill.; Joseph L. Valentine, Hayne Wells, of Chicago, Ill., and A. W. O'Hara. The company is capitalized at $1,000,000 and proposes to build an electric railway from a point on the bridge over the Mississippi River, between Hamilton, Ill., and Keokuk, Ia.

MARISSA, ILL.—The Hamilton Water Company has been incorporated with a capital stock of $6,000 by J. A. Hamilton, Henry J. Fink and William H. Hoppe. The company proposes to operate water, light and power plants.

SHIRLEY, IND.—The Shirley Telephone Company has been incorporated with a capital stock of $5,000 to operate in Hancock, Henry and Madison Counties. The incorporators are: W. W. Wilcoxen, T. O. Wilson and E. Wilcoxen.

TOPEKA, KAN.—The Kansas City & Fort Scott Electric Railway Company has been granted a charter to construct an electric railway from the terminus of the Metropolitan Street Railway in Rosedale via Stanley, Prescott, Fulton, Louisburg and Pleasanton to Fort Scott. The company is capitalized at $10,000 and the incorporators are: W. S. Quarles, of Stanley; M. M. Sweetman, of Kansas City, Mo.; D. E. Ainsworth, and T. W. Conboy, of Stilwell; W. H. Foster, R. J. Rogers, of Louisburg; M. Langan, of Paola, and others.

WINONA, MINN.—The Minnesota-Wisconsin Power Corporation has filed articles of incorporation under the laws of the State of Delaware, with a capital stock of $2,000,000, to construct and operate both electric and gas plants. The incorporators are: W. B. Parsons, C. P. Crangle and James Ritchie, of Winona, Minn.

ST. LOUIS, MO.—Articles of incorporation have been filed for the National Light & Power Company with a capital stock of $2,000 for the purpose of doing a general lighting and power business. The incorporators are: W. C. Morehead, A. B. Ewing, Jr., and Judson H. Boughton.

ENDICOTT, N. Y.—The Endicott Light, Heat & Power Company has been granted a charter with a capital stock of $5,000. The incorporators are: Perkins & Blakeslee, Lewis S. Nattoon, Isaac E. House and J. Winfield Tiffany.

MARSHALL, N. C.—Articles of incorporation have been filed for the Madison Light & Power Company with a capital stock of $10,000 by J. H. White, F. Shelton and others.

FINLEY, N. D.—The Finley Light & Power Company has been incorporated with a capital stock of $5,000 by J. A. Carlson, E. G. Quamme, O. Cummings, R. J. Sluggett, G. A. Montieth, F. E. Curry and others, all of Finley. The company proposes to construct and operate an electric plant to supply electricity for lamps and motors in Finley.

CLEVELAND, OHIO.—The Thompson Electric Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: Allison J. Thompson, Joseph Hidy, Joseph J. Klein, S. M. Davis and Edith A. Close.

COSHOCTON, OHIO.—The Coshocton Telephone Company has been incorporated with a capital stock of $150,000 for the purpose of taking over the property of the Citizens' Telephone Company and the Central Union Telephone Company in Coshocton. The incorporators are: Joseph L. Rue, L. P. Gallagher, Frank Pomerene and others.

MUSKOGEE, OKLA.—The Peabody Electric Company has been incorporated with a capital stock of $4,550 by F. H. Nebon, A. D. Peabody and W. R. Robinson, all of Muskogee, Okla.

CLEARFIELD, PA.—The Clearfield Electric Company filed articles of incorporation with a capital stock of $5,000. The directors are: John W. Wrigley, of Clearfield, Pa., treasurer; O. J. Harm, of Snow Shoe, Pa.; David Chambers, of Clarence, Pa., and A. W. Lee, and H. J. Thompson, of Clearfield, Pa.

NEW ALEXANDRIA, PA.—The New Alexandria Electric Company has been granted a charter with a capital stock of $5,000. The incorporators are: A. E. DuBois, of Wilkinsburg, Pa.; J. S. Tannehill, of Carnegie, Pa., and G. T. Smith, of Pittsburgh, Pa.

PITTSBURGH, PA.—The Wood Electric Company has been incorporated with a capital stock of $5,000 by H. V. Blaxter, Allen H. Kerr and S. K. Henderson, of Pittsburgh, Pa.

SALTSBURG, PA.—The Saltsburg Electric Company has been granted a charter by the State Department with a capital stock of $5,000. The incorporators are: H. A. Welland, of Bellevue, Pa.; E. DuBois, of Wilkinsburg, Pa., and G. T. Smith, of Pittsburgh, Pa.

RHEA SPRINGS, TENN.—Articles of incorporation have been filed for the Rhea Springs Light & Power Company with a capital stock of $1,000 by D. W. Hughes, J. C. Wasson, P. C. Chadwick and others.

COMMERCE, TEX.—The Commerce Ice & Power Company has been incorporated with a capital of $50,000 by C. A. and P. J. Struve and T. W. Smith.

FT. WORTH, TEX.—The Northern Texas Traction Company, of Ft. Worth, has been granted a franchise by the City Council of Polytechnic to extend its street railway to Ingleside Heights.

Personal.

MR. B. J. ARNOLD has been retained by the municipality of San Francisco to report on the city transportation system.

MR. HOWARD T. CASE, a graduate of Union University, Schenectady, has been appointed head of the department of publicity of the Hydroelectric Power Commission of Ontario.

MR. W. L. WATERS, of the Westinghouse Electric & Manufacturing Company, sailed November 4 on the *Kaiserin Auguste Victoria*, for a trip around the world. Mr. Waters expects to be away about six months.

MR. E. W. GOUGH, formerly assistant general manager for the New York & Queens Electric Light & Power Company, is now connected with the General Vehicle Company as superintendent of its service department, located at the works in Long Island City.

MR. SAMUEL INSULL, president of the Commonwealth Edison Company and chairman of the executive committee of the Chicago Elevated Railways, has been elected a director and a member of the executive committee of the Chicago & Alton Railroad Company.

MR. JOSEPH H. SIEGFRIED, who has been in charge of the operating department of the United Missouri River Power Company, Helena, Mont., for the past four years, has been appointed superintendent of the Winnipeg (Can.) Municipal Light Plant, with headquarters at Point du Bois, Manitoba.

MR. HENRY C. EDDY, formerly general manager of the Northern Heating & Electric Company, of St. Paul, Minn., and now general contract agent of the American Gas & Electric Company, of New York, has been making a Western trip in the interest of the electric-service properties with which he is connected.

MR. J. R. ONG, superintendent of substations, has been appointed assistant electrical engineer of the Fort Dodge, Des Moines & Southern Railroad Company. Mr. Ong is a 1909 graduate of Purdue, and he has held various positions with the Indianapolis & Cincinnati Traction Company, Indianapolis, Columbus & Southern Traction Company, Chicago, Lake Shore & South Bend Railway, and the Westinghouse Electric & Manufacturing Company.

MR. S. E. DILLON, formerly general manager of the Hot Springs Western Railroad before that line was taken over by the Iron Mountain System, has been appointed general manager of the Hot Springs Water Company, of Hot Springs, Ark., which controls the local central-station, gas, water and street-railway utilities. Mr. Dillon fills the place formerly held by Mr. H. E. Martin, whose duties have been divided between Mr. W. C. Fordyce and Mr. H. J. Lehman. Mr Edward Hardin, who recently resigned as superintendent of the street-railway service, has been succeeded by Mr. J. H. Butterfield, formerly city clerk of Hot Springs and the son of a former general manager of the Hot Springs company.

MR. S. B. WAY, chief electrical engineer of Union Electric Light & Power Company, St. Louis, has been promoted to be assistant general manager of the Milwaukee Electric Railway & Light Company, to have charge of the electric-light and power and gas departments, as well as the generating departments. Mr. Way took charge Nov. 1. Mr. Way has been chief electrical engineer for the Union Electric Company and the Imperial Company in St. Louis for the last thirteen years. Before coming to St. Louis he was erecting engineer for the Electric Storage Battery Company, of Philadelphia, which he joined after graduating from the Drexel Institute in Philadelphia in 1896. Mr. Way is a member of the St. Louis League of Electrical Interests, the Rejuvenated Sons of Jove and various St. Louis commercial clubs. On Thursday evening, Oct. 26, the heads of departments of the Union Electric Light & Power Company—Messrs. H. Spoehrer, secretary and treasurer; John Hunter, chief engineer of power plants; E. H. Shufro, purchasing agent; L. F. Philo, sales manager; F. D. Beardslee, commercial engineer, and C. E. Michel, manager automobile department—gave Mr. and Mrs. Way a dinner at the Jefferson Hotel and a theater party, at which time Mr. Way was presented with a traveling outfit. After the theater Mr. Way gave a supper to the gentlemen mentioned. On Saturday evening, Oct. 28, 175 employees in Mr. Way's department gave him a farewell banquet at the City Club. Many of the other employees outside of Mr. Way's department also attended. Mr. Way was presented with a handsome golf outfit by his employees, and at the same meeting the company section of the N. E. L. A. gave Mr. Way a set of diamond cuff-links. On Monday evening, Oct. 30, a dinner was given to Mr. Way by a number of his friends at the Mercantile Club.

S. B. WAY.

Obituary.

MR. FREDERICK P. ADDICKS, vice-president of the Amalgamated Copper Company, who was well known in the artificial lighting industry by reason of his connection with the Consumers' Gas Company, Chicago, and the Boston Gas Light Company, died at his home in New York City on Nov. 2, at the age of sixty-one years.

MR. B. G. McNABB, contract agent of the Montreal Light, Heat & Power Company, was accidentally killed by his own gun while duck hunting on Oct. 21. In attempting to draw his gun toward him in order to shoot a gull overhead the charges in both barrels were exploded with the fatal result noted. The deceased was born in St. Thomas, Ontario, on Nov. 19, 1882. He is survived by a widow and a young son.

MR. DANIEL F. DRAWBAUGH, who at one time was an important figure in telephone litigation, died at Harrisburg, Pa., Nov. 3, at the age of eighty-four. In addition to his work in the telephone field, he invented pneumatic tools, hydraulic rams, folding lunch boxes, barrel faucets, measuring machines for use in wrapping goods, and corn separators. Mr. Drawbaugh claimed to have invented a telephone as early as 1869, and that in 1871 he improved the receiver, which was still further improved in 1874, when an instrument was made which is said to be still in existence. In 1881 the People's Telephone Company was formed to press the claims of Drawbaugh to the invention of the telephone. This led to a long litigation with the American Bell Telephone Company. The controversy ended by the courts upholding the Bell patents and denying the main contentions of Drawbaugh.

Trade Publications.

PRINTING PRESS MOTORS.—Bulletin No. 85 of the Robbins & Myers Company, Springfield, Ohio, contains descriptions and illustrations of motors especially designed for the driving of flat-bed printing presses.

DIRECT-CURRENT SWITCHBOARD PANELS FOR SMALL MINING PLANTS.—The General Electric Company, in Bulletin No. 4877, describes direct-current switchboard panels, single polarity, for small mining plants. They are for use only in stations with a grounded negative. Connection and dimension diagrams are included in the bulletin.

INCLOSED FLAME-ARC LAMPS.—The General Electric Company has just issued Bulletin No. 4882 describing its inclosed flame-arc lamps. This lamp utilizes the impregnated or so-called plain carbon electrode, which gives remarkable illuminating efficiency and is so designed as to admit of the use of any of the standard makes of flame carbons available. This line of lamp comprises designs suitable for all classes of commercial service.

POWER STATION CONSTRUCTION.—The Stone & Webster Engineering Corporation has issued an attractive booklet listing its activities in power station construction work. It has completed or is working on steam stations aggregating 184,420 kw, hydroelectric developments aggregating 211,150 kw, railway work totaling 551 miles, substations of 83,825 kw capacity, and has thirty building construction contracts of various kinds.

INSULATION.—The Okonite Company, 253 Broadway, New York City, has published an attractive booklet entitled "Economy in Joint Making, with Instructions." It contains information which should be very much in demand just at this season of the year, as now is the time to make repairs in the way of insulating and protecting joints so that short-circuits, with their accompanying troubles, may be avoided during the winter to come.

AUXILIARY CONTRACTOR EQUIPMENTS.—In Folder No. 4186, the Westinghouse Electric & Manufacturing Company describes an auxiliary line switch for use on trolley cars equipped with ordinary drum-type controllers. The switch, which is mounted underneath the car, is electro-pneumatically operated and in effect is a very rugged circuit-breaker. The folder contains a complete description and photographic illustrations of the line switch and wiring diagram showing how it should be installed.

BRITISH INTERIOR WIRING CONDUIT.—The Sun Engineering Company, 120 Charing Cross Road, London, has recently issued two pamphlets relating to its "Kalkos" system of interior wiring. In this system specially drawn brass tubes turned inside and out are used, which are jointed by slip sockets and soldered. A universal outlet box is used, into which a ceiling rosette or side wall switch is simply fitted. The advantages claimed for the brass conduit are absence of condensation and ease with which the conduit may be bent to curves.

DIRECT-CURRENT INTERPOLE GENERATORS.—Descriptive Leaflet No. 2371, issued by the Westinghouse Electric & Manufacturing Company, treats of Type Q engine-driven, direct-current interpole generators manufactured by it. The leaflet, which is letter-size and arranged to bind in with correspondence, gives illustrations of type Q generators assembled, and of the important component parts. Short descriptions of the complete machines and the parts are given that enable anyone interested to form an excellent idea of the characteristics and construction of the apparatus.

WARREN BEAUTIFUL.—With this title the Sterling Electrical Manufacturing Company, Warren, Ohio, has issued a reprint in handsome form of a paper read by Mr. William Coale, treasurer of the Sterling company, at a commercial session of the National Electric Light Association. A description is included, together with illustrations, of the series tungsten street lighting system of Warren, which city was the first to adopt the "Mazda" lamps for public lighting to the exclusion of arc and gas and gasoline lamps. The pamphlet also contains in full the contract of the city with the Warren Water & Light Company for street lighting.

SWITCHBOARD AND HIGH-TENSION RELAYS FOR ALTERNATING CURRENT AND DIRECT CURRENT.—The General Electric Company has recently issued Bulletin No. 4857, which thoroughly describes its switchboard and high-tension relays. Among these relays are those for circuit-opening, time-limit relays, inverse time-limit, definite time-limit, low-voltage, no-voltage and over-load reverse current, reverse phase, etc. Each type of relay is illustrated and described, and the publication contains general notes on the use of relays, including a diagram of modern power-house wiring and buses, and the location of relays.

POLYPHASE INDUCTION MOTOR.—A polyphase motor resembling in external appearance and operating characteristics its well-known self-starting, single-phase induction motor was developed for the market two years ago by the Wagner Electric Manufacturing Company, St. Louis, Mo. This motor operates during starting and at low speeds with a high-resistance secondary, while during running it operates with a low-resistance secondary. The change from high resistance to low resistance is brought about by a short-circuiting device operated by centrifugal force. A good description of the motor is given in Bulletin No. 95.

FURNACE STOKERS.—A new catalog of the Taylor stoker has just been issued by the manufacturers, the American Ship Windlass Company, Providence, R. I. The catalog is well illustrated, the stoker parts being named in several views. Other illustrations show well-known power plants, such as the New York Edison Waterside Station, the Christian Street Station of the Philadelphia Electric Light Company and stations of the Detroit Edison Company, the Everett Mills, of Lawrence, and the Oxford Paper Company, of Rumford Falls, Maine. An interesting cut is shown of the largest stokers ever built, these being the two fourteen-retort stokers for the Hartford Electric Light Company.

WESTINGHOUSE RAILWAY EQUIPMENT.—"Westinghouse Railway Equipment" is the title of Folder No. 4184 of the Westinghouse Electric & Manufacturing Company. The folder, which is time-table size with an attractive cover, describes the spider armature construction used by the Westinghouse company, its railway motor brush holders, armature and axle bearings and unit switch control systems, both for 600 and 1200 volts. Discussions are also given of the comparative advantages of interpole and non-interpole railway motors, and of box-frame vs. split-frame motors. Many photographic reproductions are given of modern interurban and street railway cars, and beside each is tabulated an outline specification for each car, indicating what electrical and mechanical equipment is used on it, and its dimensions.

A CLEVER BOOKLET.—The Dielectric Company, St. Louis, has issued an eight-page pamphlet, handsome in execution and particularly clever in design. The pages are artistically designed, and each—except the first and last—contains a single illustration accompanied by a single sentence of a few words. On the first two facing pages are, to the left, a view of the company's manufacturing plant with the caption "Our Plant," and on the other a view of articles and packages, with the caption "Our Product." Of the following two pages, one shows a large collection of letterheads, with the caption "Our Customers," and the other, views of various kinds of apparatus, the caption being, "Our Customers' Products." On the next facing pages are, on one page, views of a section of the Panama Canal and of a war vessel moored at a navy yard, with the caption "Our Government's Use of Our Product," and on the other, a curve showing "Our Growth." On the final page is a list of the dielectric products with the note, "We would like to receive inquiries for samples and prices."

BUSINESS NOTES.

UNDERGROUND WORK IN EAST ST. LOUIS.—The Postal Telegraph-Cable Company is placing its wires underground in East St. Louis, Ill. The Graner-Mahoney Contracting Company, of St. Louis, has the contract for installing the conduits.

H. W. JOHNS-MANVILLE COMPANY.—The Birmingham (Ala.) office of the H. W. Johns-Manville Company has been moved from 1220 Empire Building to 606 Chamber of Commerce Building. The office will continue to be under the management of Mr. W. H. Fleming, who was formerly connected with the New Orleans branch of the company for a considerable time. A complete line of electrical supplies and asbestos and magnesia products will be handled from this office.

PUMPS ON WARSHIPS.—The Blake & Knowles Steam Pump Works, 115 Broadway, New York City, have installed pumping equipment on sixty-five of the 108 vessels which last week took part in the naval review at New York. Nine of the remainder carry no steam pumps, including the submarines and one sailing vessel, and eight others, principally colliers, were built abroad. The number of pumps the above-mentioned company has installed on the fleet exceeds 1000, and their cost represents nearly $1,250,000.

THE MEAD-MORRISON MANUFACTURING COMPANY, of Cambridge, Mass., has been awarded the contract for equipping the United States Navy fleet colliers No. 9 and No. 10 with coal-loading and unloading machinery. The Newport News Ship Building & Dry Dock Company is building the colliers. The United States Navy collier *Cyclops*, built by the Cramp Ship Building & Engine Company, about one year ago, was equipped with the Mead-Morrison Manufacturing Company's coal-loading and unloading apparatus.

HEAVY DEMAND FOR PLANIA CARBONS.—H. M. Hirschberg, president of the Excello Arc Lamp Company and sole importer of Plania carbons, 32 East Twentieth Street, New York City, says that present conditions in both branches of his business are highly satisfactory. Sales of the Plania carbons, he says, are surpassing the highest expectations he held for them upon their introduction, and the factories turning out his products are crowded to capacity. The Plania carbons are the product of the Plania works, in Ratibor, Silesia.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED OCT. 31, 1911.

[Prepared by Robert Starr Allyn, 16 Exchange Place, New York.]

1,007,054. CEILING-ROSE AND THE LIKE FOR USE IN ELECTRIC CIRCUITS; F. G. Bazell, Coventry, England. App. filed Dec. 18, 1909. A base, body and cover of porcelain with terminal connections.

1,007,058. MECHANICAL MOVEMENT AND ELECTRIC-LIGHT SOCKET; T. A. C. Both, New York, N. Y. App. filed June 2, 1911. Two-part porcelain block with rotary snap.

1,007,069. TREATMENT OF IRON OR STEEL TO PREVENT THE OXIDATION OR RUSTING THEREOF; T. W. Coslett, Birmingham, England. App. filed Nov. 25, 1910. A solution of zinc and iron phosphate. Action may be accelerated electrically.

1,007,125. ELECTRIC HEATER; C. P. Madsen, Chicago, Ill. App. filed July 9, 1910. For toasters, broilers, etc.

1,007,138. INSULATOR BRACKET; C. L. Peirce, Jr., Pittsburgh, Pa. App. filed Oct. 26, 1910. A ribbed support and a channel-like bracket riveted in place.

1,007,151. ELECTRODE; E. C. Speiden, Niagara Falls, N. Y. App. filed May 17, 1910. A sectional hollow electrode for electrothermic work.

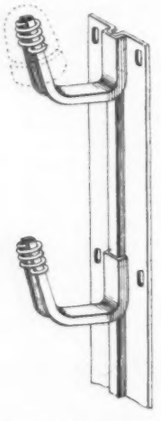
1,007,178. PRESSURE-RATIO ALARM; A. W. J. Billings, Havana, Cuba. App. filed July 21, 1909. A casing and diaphragm for determining the condition of a fire by pressure differences.

1,007,186. ELECTRIC REGULATION; J. L. Creveling, New York, N. Y. App. filed June 21, 1911. Dynamo and storage-battery lighting system.

1,007,188. WAX MELTER; J. G. Dickson, Chicago, Ill. App. filed March 9, 1911. A melting pot and electric heater for sealing wax.

1,007,192. MAGNETIC-CONTROL SYSTEM FOR RAILWAYS; A. H. Fox and A. W. Lenderoth, New York and Stapleton, N. Y. App. filed May 22, 1909. Armature sections in the roadbed and electromagnets on the cars for exerting automatic speed control.

1,007,211. ELECTRIC-ARC LAMP; M. Körting, Leutzsch, Germany. App. filed Nov. 22, 1909. When a lamp fails a compensating impedance is substituted.



1,007,138.—Insulator Bracket.

1,007,232. ATTACHMENT FOR PIANOS OR THE LIKE; A. D. Palmer, Pittsburgh, Pa. App. filed May 14, 1909. Electromagnetically operated means controlled by the pedal for using a bass drum.

1,007,243. ELECTRIC SIGNAL; E. Seget, Warsaw, Russia. App. filed June 8, 1909. Electrically released gravity semaphore for railroads.

1,007,265. METHOD OF AND MECHANISM FOR PRODUCING MUSICAL SOUNDS; G. Breed, Philadelphia, Pa. App. filed Sept. 23, 1909. Strings are vibrated electromagnetically by pulsating current.

1,007,284. ILLUMINATING DEVICE; A. J. Horner, Cleveland, Ohio. App. filed Dec. 3, 1910. A casing with a dry cell for illuminating a watch.

1,007,291. CONTINUOUS ELECTRIC SWITCH; F. M. G. Johnson, Montreal, Quebec, Can. App. filed Dec. 26, 1908. Single button for making and breaking a lamp circuit, etc.

1,007,344. TELEPHONE-SYSTEM SIGNALING APPARATUS; J. Erickson, Chicago, Ill. App. filed Feb. 5, 1910. The line signal is locked when set by the subscriber and must be released by the operator.

1,007,359. CASING FOR LAMP SOCKETS; C. J. Klein, Milwaukee, Wis. App. filed Dec. 7, 1908. Interior catches for interlocking the cap and body are released by rotating an inner sleeve.

1,007,364. SOCKET FOR INCANDESCENT ELECTRIC LAMPS; J. K. Lux, Jersey City, N. J. App. filed March 25, 1909. The cap and body of the shell have interlocking shoulders and guides.

1,007,370. SUSPENSION DEVICE FOR TROLLEY WIRES AND THE LIKE; G. A. Mead, Mansfield, Ohio. App. filed Nov. 12, 1906. A clip for engaging the messenger wire and a rod and clamp for the trolley wire.

1,007,373. BRACKET TELEPHONE; W. C. Moeller, Doon, Ia. App. filed Dec. 2, 1909. Lazy-tongs with adjustable upright for the receiver and transmitter.

1,007,386. AUTOMATIC SWITCH; J. L. Polk, Troy, N. Y. App. filed Sept. 2, 1910. Movable in one direction by hand and returned by a spring and cushioned by a dashpot.

1,007,387. AUTOMATIC SIGNAL DEVICE; F. Porto, Baltimore, Md. App. filed April 27, 1910. Railroad block system automatically setting the brakes and signaling the engineer and tower operator.

1,007,388. ELECTROLYTIC METHOD OF REFINING IRON; A. S. Ramage, Buffalo, N. Y. App. filed March 7, 1911. The impure iron is electrolytically dissolved in an acid ferric liquor and the resulting liquid is electrolyzed with insoluble anodes.

1,007,402. MOTOR-CONTROLLING DEVICE; L. L. Tatum, Milwaukee, Wis. App. filed Feb. 11, 1910. Starting rheostat for rear of switchboard use to cut out the motor regardless of the position of the controller.

1,007,419. PLURAL-LAMP SOCKET; R. B. Benjamin, Chicago, Ill. App. filed July 27, 1906. Insulation of the parts of the cover, contacts, etc., by enamel.

1,007,435. HEADLIGHT; R. M. Dooley, Rockland, Tex. App. filed Jan. 27, 1910. Arc lamp with solenoid adjustment.

1,007,438. TROLLEY-POLE SUPPORT; A. Feja, St. Louis, Mo. App. filed July 2, 1910. Notched wheel and pawl for affording yielding resistance to rotation.

1,007,441. ELECTRIC HEATER AND PROCESS OF CONSTRUCTING THE SAME; W. S. Hadaway, Jr., East Orange, N. J. App. filed March 15, 1909. Sheets of asbestos are soaked in japan and baked, then redipped and assembled with the resistance elements.

1,007,446. ELECTRIC HEATER; A. F. Jacobson, New York, N. Y. App. filed Aug. 6, 1910. A shell and coils for a printing machine for preventing sheets of paper from cohering.

1,007,456. CONTROLLER FOR ELECTRIC MOTORS; F. W. Lacey, Bournemouth, England. App. filed March 2, 1910. A lock for the reverser drum of such type as Patent No. 611,465.

1,007,457. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINERY; B. G. Lamme, Pittsburgh, Pa. App. filed April 13, 1905. Bolts through the insulating block and the ends of a yoke to prevent warping of the coils.

1,007,469. COMMUTATOR FOR DYNAMO-ELECTRIC MACHINES; F. S. Martin, Edgewood Park, Pa. App. filed Oct. 18, 1909. Superposed clamping rings seated in V-shaped notches in the commutator bars.

1,007,480. ALTERNATING ELECTRIC-CURRENT DISTRIBUTION SYSTEM; G. North and J. S. Peck, Manchester, England. App. filed April 12, 1909. Main and auxiliary transformers and a relay and switches for regulation.

1,007,482. ALTERNATING-CURRENT TRANSFORMER SYSTEM; J. S. Peck, Manchester, England. App. filed Oct. 7, 1909. A lamp or fuse for indicating a short-circuit in an auxiliary transformer.

1,007,506. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINES; E. M. Tingley, Pittsburgh, Pa. App. filed Feb. 20, 1906. Multipart radial supports and coils interfitted around the core to prevent warping.

1,007,513. ELECTRIC PROCESS FOR DRYING TIMBER; A. U. Alcock, Perth, Western Australia, Australia. App. filed Nov. 4, 1910. Liquid electrodes for the ends of logs, etc.

1,007,527. TELEGRAPH SYSTEM; M. J. Carpenter, La Grange, Ill. App. filed April 19, 1910. Composite telephone and telegraph system for train dispatching, etc.

1,007,544. POLICE SIGNAL SYSTEM; A. K. Dement, Pittsburgh, Pa. App. filed Oct. 12, 1910. Signal box with recorder; three-wire circuit with direct current and alternating current.

1,007,545. SIGNAL SYSTEM; A. K. Dement, Pittsburgh, Pa. App. filed March 17, 1911. Three-wire circuit, any wire of which can be grounded at the outer end.

1,007,562. BRUSH HOLDER FOR DYNAMO-ELECTRIC MACHINES; F. C. Hanker, Wilkinsburg, Pa. App. filed Oct. 7, 1908. Has side by side and oppositely disposed inclined brush guides.

1,007,575. TELEPHONE SYSTEM; H. F. Joeckel, Camp Point, Ill. App. filed March 16, 1911. Magneto local-battery talking set. Improvement on Patents No. 955,335 and No. 982,209.

1,007,617. COIL SUPPORT FOR DYNAMO-ELECTRIC MACHINERY; E. M. Tingley, Pittsburgh, Pa. App. filed April 10, 1905. An annular set of supports fits between and against the coil ends to prevent displacement of the coils.

13,301 (Reissue). PULL SOCKET FOR ELECTRIC SWITCHES; F. Barr, New York, N. Y. Double break with new contacts and insulation. Original Patent No. 958,988.